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EXPLORING OPTIMISM IN RECOMMENDATIONS ACCOMPANYING ANALYST CONFLICT OF INTEREST RULES

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ABSTRACT

This study examines bias in recommendations following the enactment of the research analyst conflict of interest rules introduced around 2002. We label analyst recommendations as being seemingly unaffiliated when contributors are not underwriters but an acquirer or target firm of underwriters. We find that after the introduction of the rules, bias in affiliated recommendations diminishes, whereas seemingly unaffiliated recommendations reveal no signs of difference in their level of optimism. Moreover, both affiliated and seemingly unaffiliated analysts disproportionately issue unfavorable recommendations for unaffiliated firms immediately before the effective date of the rules. Our empirical evidence indicates that seemingly unaffiliated recommendations are subject to conflicts of interest. During the process of mergers and acquisitions, analysts from target firms appear to issue more optimistic recommendations than unaffiliated analysts do on their acquirer firms' clients. After the announcement date, recommendations issued by target analysts are more optimistic than those by unaffiliated analysts despite the fact that former recommendations are relatively pessimistic before the announcement date.

JEL: G24; G28; G34; M41

KEYWORDS: Analyst recommendation; Mergers and acquisitions; Conflicts of interest

INTRODUCTION

A series of changes has taken place over the past two decades among financial institutions. On one hand, a number of mergers and acquisitions (hereafter M&A) have remodeled the landscape of the industry greatly, creating an increasingly complex network. On the other hand, regulations were introduced to address the conflicts of interest and biases reflected in analyst recommendations. Analysts affiliated with an underwriter have received the most attention from both researchers and regulators. We find this description of analyst conflict of interest not a comprehensive picture without detailed analytical accounts of the recommendation behavior of those analysts whose affiliation relationships change along with M&A activities. Therefore, a new definition of analysts' *affiliation* status may benefit our understanding of analyst optimism since these analysts' identities and potential conflicts of interest cannot be fully accounted for by a simple affiliated and unaffiliated dichotomy.

This study closely examines those previously thought to be "unaffiliated" and thus "unbiased" analyst recommendations during the period from 1997 to 2007. For the contributors that are not the underwriters but the acquirer or target firm of the underwriters, we label their analyst recommendations as being *seemingly unaffiliated.* By focusing on this particular group of analysts in the M&A context, we hope to shed new light on the interactions and causality between analysts' affiliation status and recommendation optimism, thus expanding and consolidating our current knowledge of the mechanism of analyst bias. To further our understanding, we also examine the effectiveness of analyst conflict of interest rules in the hope of understanding how regulations may influence sell-side analysts' recommendations in what ways and to what extent.

Existing studies have documented analyst optimism. On one hand, analysts tend to cover the company for which they have truly positive future prospects; in so doing, these analysts' coverage increases the likelihood of their firms to be chosen as underwriters. And when their firms win the underwriting

mandates, the analysts' recommendations become affiliated. On the other hand, analysts may deliberately provide favorable investment recommendations to curry favor with management and/or provide support for previous client companies. In spite of the underlying motivational differences, both situations lead to optimism in the recommendations issued by analysts affiliated with an underwriter--the former is an example of selection bias while the latter is an example of strategic bias. To discern between selection and strategic bias is difficult because of their similar outcomes, but this distinction is beneficial for investors to discount strategic *buy* recommendations, and for regulators to measure the mitigation of conflicts of interest that accompany related rules.

The two types of biases discussed above lead to a similar result that affiliated recommendations are more optimistic than unaffiliated recommendations. In hopes of sorting out this confusing situation, we pose the following question, which forms the basis of this current research: Are these analysts' recommendations, issued by the analysts implicated in an ongoing M&A, affiliated or unaffiliated? Aiming to put a prism into the optimism puzzle, we focus on a number of M&A among financial institutions over the past two decades, examining the seemingly unaffiliated recommendations and comparing their optimism levels with unaffiliated recommendations sequential to the enactment of related rules. We also analyze the recommendation bias of target analysts covering the acquirer's clients and that of the acquirer analysts covering the target's clients.

We further explore recommendation bias in the stages during the M&A process. By treating a major M&A event as the epicenter and by mapping out its possible seismic effects—in the form of foreshocks and aftershocks—into four sample periods, we find that analysts provide the most optimistic recommendations on M&A counterpart's clients during the period between the announcement and effective date. However, after the M&A is complete, bias level diminishes over time. These results support the notion that the incentive for analysts' strategic bias still exists despite the fact that the financial press has cast doubt on analysts' credibility and regulators have enacted rules to improve information disclosure in analyst reports, such as the research analyst conflict of interest rules introduced around 2002. By examining the convergence of the enactment of the rules and the M&A events, we find that the gray zone of an M&A between its announcement and effective dates becomes a loophole in the Chinese Wall: the regulators have no say in overseeing affiliation that has not taken effect, and the investors are unaware of this newly-formed delicate relationship. Our research results show that conflicts of interest still contribute to the bias in analysts' recommendations following the regulations.

Our paper contributes to existing literature in several ways. First, we identify the seemingly unaffiliated analysts, a specific group of affiliation driven by M&A events. Second, we provide new evidence for the impact of the research analyst conflict of interest rules on analysts' optimism in recommendations and gauge their effectiveness on seemingly unaffiliated analysts. Third, we analyze the rating distribution immediately before the effective date of conflict of interest rules and find that analysts disproportionately issued more unfavorable recommendations for unaffiliated firms than affiliated firms. Fourth, we discuss alternative perspectives on selection bias and strategic bias.

The rest of the paper is organized as follows. Section 2 provides a brief institutional and regulatory background. Section 3 reviews the related literature and develops the hypotheses. Section 4 describes the sample selection and the affiliation network construction. We present the research design and results in Section 5 and conclude in Section 6.

INSTITUTIONAL AND REGULATORY BACKGROUND

The Securities and Exchange Commission (SEC) and the self-regulatory organizations (SROs) responded to the analyst scandals in the late 1990s and early 2000s. Extensive rules were imposed on the security research industry to diminish the conflicts of interest in analyst reports. These rules include the Regulation Fair Disclosure (hereafter Reg-FD), NASD Rule 2711 ("Research Analysts and Research Reports"), NYSE amended Rule 472 ("Communications with the Public"), and the Global Analyst Research Settlements (hereafter GS). To enforce the Reg-FD, the SEC prohibits publicly traded

companies and other issuers from making selective disclosures of nonpublic information by issuers to privileged individuals or entities, such as stock analysts, effective as of October 23, 2000. According to NASD Rule 2711 (h)(5) and NYSE amended Rule 472 (b)(3), SROs require disclosure in research reports of the distribution of *buy/hold/sell* ratings and the percentage of investment banking clients within the previous twelve months in each category, announced on May 10, 2002 and effective as of September 9, 2002. For instance, Lehman Brothers disclosed the distribution of ratings in the recommendation report covering JPMorgan Chase & Co on September 21, 2007 as follows:

> *Lehman Brothers Equity Research has 2,073 companies under coverage.*
> *39% have been assigned a 1-Overweight rating which, for purposes of mandatory regulatory disclosures, is classified as Buy rating, 29% of companies with this rating are investment banking clients of the Firm.*
> *44% have been assigned a 2-Equal weight rating which, for purposes of mandatory regulatory disclosures, is classified as Hold rating, 39% of companies with this rating are investment banking clients of the Firm.*
> *12% have been assigned a 3-Underweight rating which, for purposes of mandatory regulatory disclosures, is classified as Sell rating, 26% of companies with this rating are investment banking clients of the Firm.*

The Chinese Wall between research and banking divisions appear to be higher after the GS required ten of the largest banks to physically insulate their analyst and banking departments, an agreement reached on April 28, 2003. As another requirement, part of the settlement by these banks with regulators sanctioned them to spend $450 million to contract with no less than three independent research firms to provide research reports on the brokerage firm's clients. Unlike the disclosure of ratings distribution, this one had a five-year limit, ending in July 2009. This requirement may influence the recommendation ratings of unaffiliated analysts in the sample period 2004-2009. Jacob, Rock, and Weber (2008) argue that conflicts of interest for these independent research firms' analysts may arise since analysts' firms are paid for the research they provide. Because of these regulations, we investigate whether the recommendation ratings between *buy* and *sell* became more balanced, and whether the links between analysts' favorable views and their investment banks' underwriting business became weaker during the post-regulatory period.

Previous studies show that the percentage of *buy* recommendations decreased steadily subsequent to these regulations. Likewise, Barber, Lehavy, McNichols, and Trueman (2006) suggest that the sharp change cannot be explained by macroeconomic conditions but is an indicator of the effect of the implementation of NASD Rule 2711. Recent evidence (e.g., Kadan, Madureira, Wang, and Zach, 2009) reveals that the Chinese Wall regulations have diminished the bias of affiliated analysts documented in the pre-regulatory period.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

This paper is related to three strands of literature. First, selection bias and strategic bias contribute to optimism in analysts' recommendations. Second, lead and co-manager affiliated analysts provide favorable recommendations for clients in hopes of securing or garnering an underwriting business. Third, the enactment of analyst conflicts of interest rules influences security analysts' recommendations.

In the late 1990s, approximately 70% of analysts' recommendations were *buy* and *strong buy*. Most academic research and financial media claim that those optimistic recommendations are attributable to investment banking business. McNichols and O'Brien (1997) find that analysts tend to follow stocks for which they have favorable views, and drop coverage of stocks for which they have unfavorable views. They provide an alternative explanation, namely that the optimistic bias results from self-selection. In contrast to this view, a number of studies show the underlying links between analysts' optimistic recommendations and investment banks' equity underwriting business. Lin and McNichols (1998) study

earnings forecasts and recommendations for firms with seasoned equity offerings (SEO) and find that lead and co-underwriters' analysts have more optimistic recommendations and growth forecasts, but their short-term earnings forecasts are not as optimistic as those of unaffiliated analysts. Michaely and Womack (1999) examine the recommendations for firms with initial public offerings (IPO) and find that lead underwriters' analysts have more optimistic recommendations than unaffiliated analysts have. They also find that investors cannot recognize affiliated analysts' conflicts of interest and discount their biased opinions so that they underperform after following the recommendations by affiliated analysts compared to those by unaffiliated analysts.

In the same fashion, both lead and co-manager analysts provide overoptimistic recommendations following IPOs (James and Karceski, 2006; Bradley, Jordan, and Ritter, 2008). O'Brien, McNichols, and Lin (2005) find that affiliated analysts downgrade their recommendations more slowly. Cliff (2007) argues that selection bias cannot explain the abnormal returns generated in *sell* recommendations by lead underwriter-analysts. With a focus on changes of recommendation bias derived from the different status of affiliation, we introduce a specific group of affiliation driven by M&A events to observe the analysts' being unaffiliated, seemingly unaffiliated and affiliated throughout the different stages of an M&A process.

Krigman, Shaw, and Womack (2001) survey firms that conducted an SEO within three years of their IPO and switched lead underwriters in the period 1993-1995. They find that 88% of the survey responses by the chief financial officers (CFOs) claim coverage-related concerns as a major reason for switching. The CFOs conclude that the main reason for selecting new lead underwriters is that they can strategically buy additional and influential analyst coverage. Nevertheless, Mehran and Stulz (2007) reason that the results of such a survey should not be taken as evidence that CFOs look for biased coverage, but the results do show that they are more concerned with the frequency of coverage. Moreover, Ljungqvist, Marston, and Wilhelm (2006) investigate whether recommendations that are biased upward above consensus ratings help investment banks win underwriting business as lead manager in the period 1993-2002. They find no evidence that aggressive analyst behavior increases their firm's probability of being lead manager, but a prior lending relationship may increase its probability. Furthermore, they conclude that a prior underwriting relationship is also a main determinant for an issuer in choosing the firm's lead manager. On the other hand, Ljungqvist et al. (2009) find that more optimistic recommendations and even the mere coverage for the issuers increase their firm's probability of being co-manager. With the position of co-manager, though there is no prior lending relationship, the chances of serving as lead in the future are still strengthened. These empirical results indicate that the issuing companies consider analysts coverage to be part of the services of the lead manager, and the co-managers that provide positive analyst coverage also increase their probability of becoming the lead manager in the future. Since aggressive analyst behavior may have different influences and originate from varying degrees of motivations towards ingratiation, we present lead and co-managers in supplementary Panels.

We draw on the work of Kadan et al. (2009), who document that affiliated analysts are more likely to provide optimistic recommendations than unaffiliated analysts in the period between November 2000 and August 2002, but the impact of affiliation on optimistic recommendations is no longer significant in the period between September 2002 and December 2004. But there is also evidence that affiliated analysts are still reluctant to provide pessimistic recommendations. Similarly, Ertimur, Sunder, and Sunder (2007) document that the integrity of *buy* and *hold* recommendations improved after May 10, 2002 because the affiliated analysts who had accurate earnings forecasts performance were willing to use their superiority to provide more profitable recommendations. They conclude that analyst conflict of interest arising from underwriting business of their employer was mitigated subsequent to the regulatory reforms.

However, these studies design their analyses around separating the sample based on recommendation types (*buy/hold/sell*): they pay relatively little attention to investigating the rating level of affiliated recommendations, as unaffiliated recommendations are pessimistic on issuing firms. In contrast to those papers, we focus on the differences of recommendations rather than on separate optimism or pessimism ratings. Our study follows Lin and McNichols (1998) in investigating the differences between these two

groups. This approach helps determine whether affiliated analysts are unduly more optimistic than unaffiliated analysts in spite of the implementation of the rules. With a method different from previous studies, we first discern the seemingly unaffiliated analysts and examine the bias in their recommendations. Our research goal is to explore the strategic bias phenomenon that accompanies the research analyst conflict of interest rules. We conjecture that the affiliated analysts avoid providing more optimistic recommendations than unaffiliated analysts because both the media and the investors are aware of the underwriting ties. Moreover, affiliated analysts are also subject to the regulation that demands information disclosure. However, we conjecture that the seemingly unaffiliated analysts, because of the niche of their concealed conflicts of interest, on the contrary, tend to provide more optimistic recommendations than unaffiliated analysts. This may also be explained by the fact that their relations with underwriters are not as publicly known, thus attracting less attention. We capture this conjecture in Hypotheses 1a and 1b:

H1a: underwriter-analysts issue more optimistic recommendations than unaffiliated analysts subsequent to the analyst conflict of interest rules.

H1b: seemingly unaffiliated analysts issue more optimistic recommendations than unaffiliated analysts subsequent to the analyst conflict of interest rules.

Different from previous studies, which break their empirical sample on May or September, 2002 in examining the influence of regulation, we set the interim period from the announcement and effective date of the rules (May 10, 2002 to September 9, 2002). We investigate the rating levels of a large number of recommendations—4,269 provided only on September 8, 2002—which were issued immediately ahead of the effective date of rules. We conjecture that the affiliated analysts avoid providing pessimistic or neutral recommendations on their clients, even though related regulations have inspired analysts to provide more *sell* recommendations. We capture this conjecture in Hypothesis 2:

H2: immediately ahead of the effective date of conflict of interest rules, analysts disproportionately issued more unfavorable recommendations for unaffiliated firms than affiliated firms.

We further compare the recommendations issued by seemingly unaffiliated analysts with those issued by unaffiliated analysts in different stages of M&A process. We conjecture that the most biased recommendations are issued by the analysts implicated in an ongoing M&A, which results from their conflicts of interest and also their concern for job security. As some of the analysts become redundant employees at the newly merged company, they may have incentive to curry favor with their own management. We conjecture that the bias continues to emerge within one year following the effective date of an M&A, but the bias level gradually diminishes as the public begin to associate the seemingly unaffiliated analysts with affiliated analysts, thus canceling the privilege enjoyed by seemingly unaffiliated analysts. We capture this conjecture in Hypothesis 3:

H3a: seemingly unaffiliated analysts issue more optimistic recommendations on their acquirer firm's clients than on those by unaffiliated analysts during the M&A process stages.

H3b: seemingly unaffiliated analysts issue more optimistic recommendations on their target firm's clients than on those by unaffiliated analysts during the M&A process stages.

DATA AND METHODOLOGY

We retrieve analysts' recommendations and broker translation files from Institutional Brokers' Estimate System (I/B/E/S). In April 2009, I/B/E/S created a new version for its recommendation database, in which 10,241 and 2,462 observations under estimator LEHMAN and SCOTT are left out. The former represents 2.66% and the latter represents 0.64% of our total 385,026 records that constitute our sample period from November 1996 to February 2008. Since these deletions may influence our analysis, we adopt a previous version of I/B/E/S. To identify the roles of lead and co-managers in the IPO and SEO

issues during the period from January 1994 to December 2008, we adopt the Securities Data Corporation (SDC) database of the public offerings in US markets, with the elimination of offerings that are classified as investment funds. There are 5,164 IPOs and 7,542 SEOs.

There have been a significant number of mergers and acquisitions among financial institutions over the past two decades. Their significant influences on the relationship network among independent research firms, brokerages, and investment banks are especially obvious from 1997 to 2001. We use three databases and three supplementary sources to construct the relationship periods and types of each affiliated group. Descriptions of the procedure in detail are as follows:

We peruse the files of I/B/E/S BRANFILD and BRANFILI, and find that a broker's long name (BKNAME) changes within the sample period. From the SDC global new issue database, we obtain all managers' parent company variables from the SDC global new issue database, and group underwriters that are identified as being with the same parents. From the SDC Mergers & Acquisitions database, we collect the US and Non-US M&A completed events including not only merger and acquisition deals but also acquisition of assets, acquisition of certain assets, acquisition of majority interest, acquisition of partial interest, and acquisition of remaining interest in order to ensure that our data include brokerage division spin-offs.We further adopt three supplementary sources. We retrieve related information on Factiva, and refer to the footnotes extracted from Thomson One's "miscellaneous" item on US financial companies. We also hand collect the recognition on company websites. These procedures help us specify the affiliation periods and types of each group.

Based on our affiliated network construction, we refine the definition of affiliated recommendations. If a report contributor that employs financial analysts is an underwriter (i.e. an investment bank) or is an affiliated member of an underwriter throughout the history, we classify this as being an obvious broker-underwriter relationship. If a report contributor is affiliated with the underwriters following certain events, such as a merger or an acquisition of assets and/or stakes, we then classify this as being an unobvious broker-underwriter relationship. Recommendations on an IPO or SEO issuer firm with an obvious broker-underwriter relationship between the report contributor and the lead or co-managers are classified as affiliated recommendations. Recommendations on an IPO or SEO issuer firm with an unobvious broker-underwriter relationship between the report contributor and the lead or co-managers are classified as seemingly unaffiliated recommendations. Subsequently, we observe their relationship for one year prior to the event announcement date. Moreover, we verify the seemingly unaffiliated recommendations that are provided during each of the following periods: (1) one year prior to the M&A announcement date (2) between the announcement and the effective date (3) within one year after the effective date (4) over one year past the effective date. These relationship period categories help us identify patterns of change in the analysts' recommendation bias under the acquirer and target firms around the time of an M&A event. To test our Hypotheses 3a and 3b, we separate the seemingly unaffiliated analysts into acquirers and targets to investigate their difference in recommendation bias.

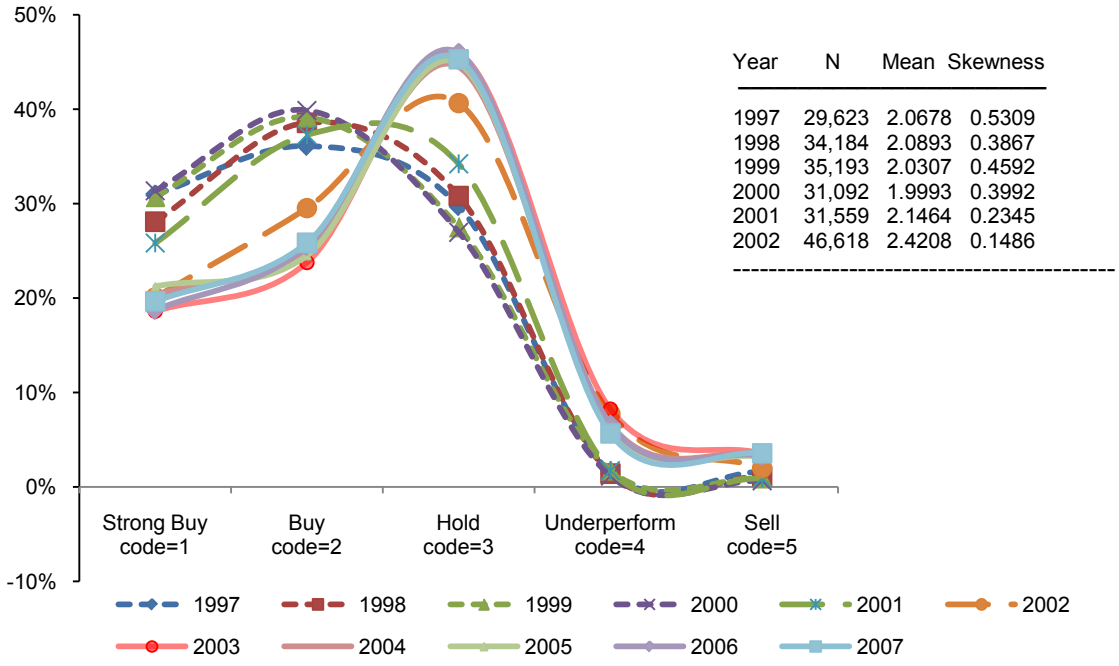
We further specify an unaffiliated recommendation with the following definition: First, recommendations on an IPO or SEO issuing firm neither with an obvious broker-underwriter relationship nor with an unobvious broker-underwriter relationship are classified as unaffiliated recommendations. Namely, the report contributor is a pure brokerage firm or an independent research firm in the U.S. financial market in the period 1994-2008. Second, recommendations on an IPO or SEO issuer firm either with an obvious broker-underwriter relationship or with an unobvious broker-underwriter relationship issued: (1) not subsequent to the offering's issue date within three years; (2) not subsequent to the offering's filing date within one year; (3) not prior to the offering's issue date within one year are classified as unaffiliated recommendations. This definition is adopted because at the time of recommendation issuance, there is no strong evidence for an affiliation relationship and therefore a lack of potential conflicts of interest. We rule out the possibility of remaining influences exerted by a long-gone relationship that has ended for over three years or a future relationship that is not yet foreseeable in one year's time.

In the next step, we collect the affiliated and seemingly unaffiliated recommendations for each security offering company, and match them with the unaffiliated recommendations. To test Hypotheses 1 and 3, we conduct a test for our paired-up sample with a design that meets the following three requirements: 1) all the analyst recommendations investigated are within one year of common stock offering, 2) two pairs of recommendation are established by using the offering issue date as a reference point; that is, a pre-offering pair and a post-offering pair, and 3) the recommendation dates of a matched pair are within sixty calendar days. When there are multiple observations for a security offering, the lead or co-managers affiliated recommendation provided on the date closest to the issue date is selected from the sample. Similarly, when there are multiple observations for a counterpart, an unaffiliated recommendation provided on the date immediately prior to or subsequent to the date of an affiliated recommendation is selected.

EMPIRICAL RESULTS

Figure 1 depicts by year the distribution of recommendation ratings across *strong buy, buy, hold, underperform*, and *sell*. The distribution consistently shows a positive skew, which indicates analysts' significantly greater optimism or higher tendency to withhold negative opinions prior to the implementation of FD-reg, and the degree of over-optimism was moderated subsequent to the implementation of ratings distribution disclosure requirement, effective as of September 9, 2002.

Figure 1: Distribution of Recommendation Ratings and Descriptive Statistics by Year



Year	N	Mean	Skewness
1997	29,623	2.0678	0.5309
1998	34,184	2.0893	0.3867
1999	35,193	2.0307	0.4592
2000	31,092	1.9993	0.3992
2001	31,559	2.1464	0.2345
2002	46,618	2.4208	0.1486

Figure 1 depicts by year the distribution of recommendation ratings from 1997-2007. The proportion of hold recommendations increases from 26.97% to 34.22% in 2001, and then rises to 40.65% in 2002. The solid lines represent the recommendations issued subsequent to the end of 2002; the thick solid line represents the recommendations issued in 2003. The largest proportion of underperform recommendations is 8.25% in 2003. With a skewness coefficient of 0.1 and the greatest mean of 2.54, the ratings distribution in 2003 appears to be more balanced. Two of the largest proportions of hold recommendations are around 46% in 2006 and 2003.

Five of the largest proportions of *hold* recommendations are from 44.85% to 45.96% during the period from 2003 to 2007. The largest proportion of *underperform* recommendations is 8.25% in 2003. The figure shows a more balanced ratings distribution with a skewness coefficient of 0.1 in 2003 accompanying the enactment of the rules. These results expand on those documented by Barber et al. (2006). The proportion of *hold* recommendations increased from 26.97% to 34.22% in 2001, and then

rose to 40.65% of total recommendations in 2002. We measure the average level of ratings by the I/B/E/S 5-tier rating system. Namely, I/B/E/S maps each contributor's naming convention to its own numeric coding system on a scale of 1 to 5 as follows: *strong buy* (code = 1), *buy* (code = 2), *hold* (code = 3), *underperform* (code = 4), and *sell* (code = 5). The highest mean recommendation rating is 2.54, indicating that analysts became less optimistic in 2003.

Our research design is in contrast to Kadan et al. (2009), who document that the coefficient of affiliation dummy is significantly positive on optimistic recommendations in the period between Post-FD reg and Pre-GS, but is not statistically different from zero in the Post-GS period. They also find evidence that the coefficient of affiliation dummy is significantly negative on pessimistic recommendations in both Pre-GS and Post-GS periods. Instead of separating the optimistic and pessimistic recommendations, we conduct our analysis to compare the rating levels between affiliated vs. unaffiliated and seemingly unaffiliated vs. unaffiliated pairs in our subsample to test Hypotheses 1 and 3.

Table 1: Differences of Means between Affiliated and Unaffiliated Recommendations

	N	Mean		Difference			P-Value	
		Affiliated	Unaffiliated	Difference	Std Dev	t-stat	t	Z
Panel A. Full Sample								
Pre-reg	3,256	1.7213	1.9270	-0.2057***	0.9601	-12.22	0.0000	0.0000
AnnEff	291	2.0805	2.2686	-0.1881***	1.1673	-2.75	0.0032	0.0024
Postreg	2,150	2.2889	2.3781	-0.0892***	1.1589	-3.57	0.0002	0.0008
Test for equality		Kruskal-Wallis			Median One-Way			
of distribution		Chi-Square	14.18		Chi-Square	9.32		
across three periods:		P-Value	0.0008		P-Value	0.0095		
Panel B. Lead manager								
Pre-reg	1,852	1.7181	1.9332	-0.2151***	0.9580	-9.66	0.0000	0.0000
AnnEff	199	2.0980	2.2797	-0.1817**	1.1455	-2.24	0.0132	0.0118
Postreg	1,318	2.3668	2.4310	-0.0642**	1.1523	-2.02	0.0217	0.0510
Test for equality		Kruskal-Wallis			Median One-Way			
of distribution		Chi-Square	14.19		Chi-Square	10.21		
across three periods:		P-Value	0.0008		P-Value	0.0061		
Panel C. Co-manager								
Pre-reg	1,404	1.7254	1.9187	-0.1933***	0.9631	-7.52	0.0000	0.0000
AnnEff	92	2.0426	2.2446	-0.2020*	1.2195	-1.59	0.0578	0.0470
Postreg	832	2.1654	2.2942	-0.1288***	1.1690	-3.18	0.0008	0.0015
Test for equality		Kruskal-Wallis			Median One-Way			
of distribution		Chi-Square	1.79		Chi-Square	0.81		
across three periods:		P-Value	0.4076		P-Value	0.6681		

*This table reports differences in means between affiliated and unaffiliated recommendation. The means of difference decreased following the rules. Pre-reg represents the recommendations before the announcement date of regulation (January 1, 1997 to May 8, 2002); AnnEff represents the recommendations during the interim period from announcement to effective dates (May 10, 2002 to September 9, 2002); Post- reg represents the recommendations after the effective date of regulation (September 10, 2002 to December 31, 2007). The symbols ***, **, * denote significance levels of 1%, 5% and 10%, respectively, for the one-tailed test in which the mean equals zero.*

In contrast to Barber et al. (2006), who separate their empirical sample on September 9, 2002 into the pre- and post-period, we take notice of the substantial number of *hold* and *sell* recommendations between the announcement and effective dates and then divide our sample into three subsamples: the pre-regulation period prior to the announcement date (May 10, 2002); the interim period from the announcement to the effective date of the rules; and the post-regulation period subsequent to the effective date (September 9, 2002).

Table 1 shows the differences between affiliated and unaffiliated recommendations. The means of difference decreased following the rules but were still significantly negative with *t*-statistic at the 1% significance level, with the exception of lead managers' difference in the post-regulation period in Panel B and two smaller sample groups in the interim period. The lead managers' difference shrank from -0.2151 to -0.0642, which shows that their optimism in affiliated recommendations was mitigated. We also perform a test to examine whether significant differences exist between the subsample periods. The evidence from Panel A and Panel B indicates that the full sample of underwriters and lead managers have significantly different distributions in three periods, but as indicated by the chi-square, the co-managers' difference has no significantly different distributions in these periods respective with a p-value of 0.41 and 0.67 in the Kruskal-Wallis and Median One-Way tests. In light of the significant difference in the behavior between co- *vis-a-vis* lead managers, we have thus identified a latent subgroup that is distinguishable but largely neglected—the seemingly unaffiliated.

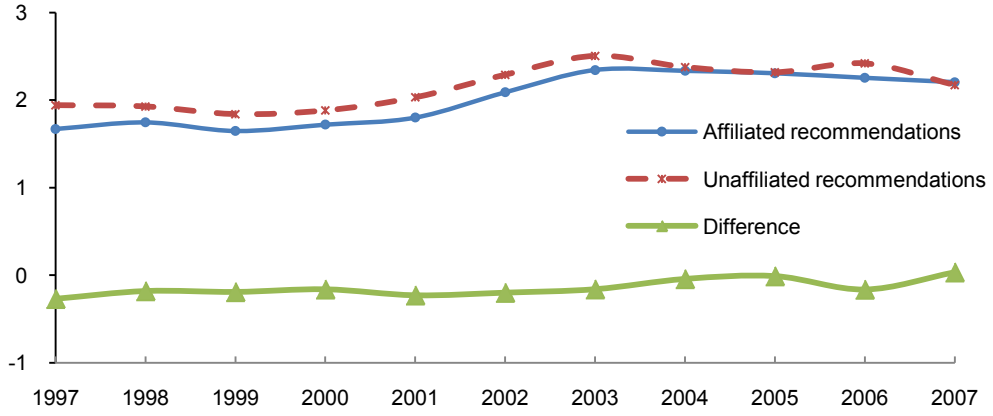
Table 2: Differences of Means between Seemingly Unaffiliated and Unaffiliated Recommendations

	N	Mean			Difference		P-Value	
		Seemingly unaffiliated	Unaffiliated	Difference	Std Dev	t-stat	t	Z
Panel A. Full Sample								
Pre-reg	1,774	1.7375	1.8867	-0.1493***	0.9459	-6.65	0.0000	0.0000
AnnEff	181	2.2136	2.2855	-0.0718	1.0306	-0.94	0.1749	0.1194
Postreg	1,367	2.2042	2.3492	-0.1450***	1.2564	-4.27	0.0000	0.0000
Test for equality		Kruskal-Wallis			Median One-Way			
of distribution		Chi-Square	1.28		Chi-Square	0.73		
across three periods:		P-Value	0.5281		P-Value	0.6946		
Panel B. Lead manager								
Pre-reg	720	1.7347	1.8719	-0.1372***	0.9147	-4.02	0.0000	0.0000
AnnEff	120	2.2250	2.3222	-0.0972	1.0777	-0.99	0.1625	0.1715
Postreg	826	2.2547	2.3669	-0.1121***	1.2582	-2.56	0.0053	0.0065
Test for equality		Kruskal-Wallis			Median One-Way			
of distribution		Chi-Square	0.36		Chi-Square	0.10		
across three periods:		P-Value	0.8361		P-Value	0.9497		
Panel C. Co-manager								
Pre-reg	1,054	1.7394	1.8969	-0.1575***	0.9669	-5.29	0.0000	0.0000
AnnEff	61	2.1913	2.2131	-0.0219	0.9376	-0.18	0.4281	0.2399
Postreg	541	2.1271	2.3222	-0.1952***	1.2530	-3.62	0.0002	0.0001
Test for equality		Kruskal-Wallis			Median One-Way			
of distribution		Chi-Square	2.29		Chi-Square	1.06		
across three periods:		P-Value	0.3186		P-Value	0.5892		

*This table reports the differences in means between the seemingly unaffiliated and unaffiliated recommendation. The means of difference do not see a significant decrease following the rules. Pre-reg represents the recommendations before the announcement date of regulation (January 1, 1997 to May 8, 2002); AnnEff represents the recommendations during the interim period from announcement to effective dates (May 10, 2002 to September 9, 2002); Post- reg represents the recommendations after the effective date of regulation (September 10, 2002 to December 31, 2007). The symbols ***, **, * denote significance levels of 1%, 5% and 10%, respectively, for the one-tailed test in which the mean equals zero.*

Figure 2: Analyst Recommendations by Year

(a) Affiliated vs. unaffiliated



(b) Seemingly unaffiliated vs. unaffiliated

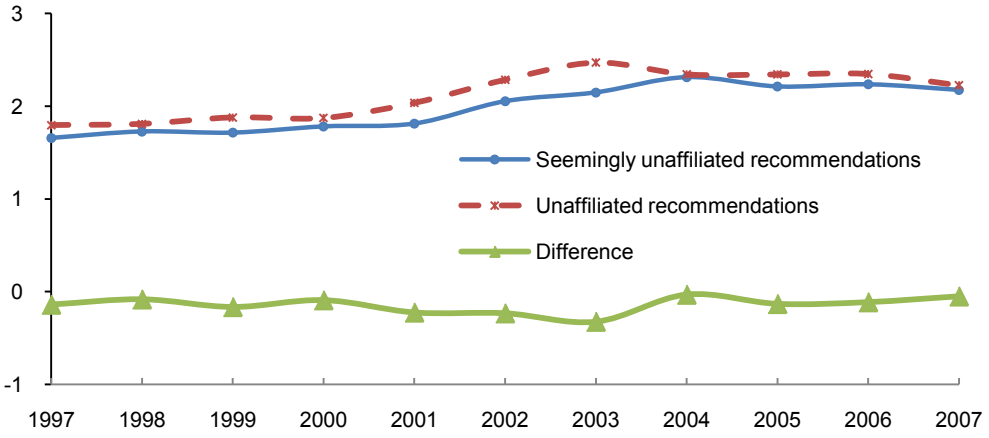


Figure 2 depicts by year the means of recommendation ratings and differences between two groups: (a) affiliated and unaffiliated; (b) seemingly unaffiliated and unaffiliated. The differences are converged in Figure 2(a) and the yearly mean of difference between affiliated and unaffiliated recommendations is positive in 2007 for the first time. The differential degree of optimism in either Figure 2(a) or (b) does not seem to be observable in year 2004, but we can clearly observe in (b) that in 2003 seemingly unaffiliated analysts were significantly more optimistic than unaffiliated analysts.

Thus, evidence supports our alternative Hypothesis 1a that underwriter-affiliated recommendations are more favorable than unaffiliated recommendations in the post-regulation period. This result is inconsistent with Kadan et al. (2009). It may be because their data only cover the period before the end of 2004. In addition, an even more explanatory reason we can find is that they have only considered an underwriting relationship that exists two years prior to the time of the issuance of recommendation. In contrast to their research, our research design has taken into consideration the many facets of a more dynamic, complex, and intricate network of affiliated relationships. In other words, we use a well-defined control group to serve as a comparison to the unaffiliated.

Although a differential degree of optimism in either Figure 2(a) or (b) does not seem to be observable in the year 2004, we can see clearly in (b) that in 2003, seemingly unaffiliated analysts were significantly more optimistic than unaffiliated analysts. Accordingly, Table 2 gives strong evidence for this observation and supports our alternative Hypothesis 1b that seemingly unaffiliated recommendations are still more favorable than unaffiliated recommendations in the post-regulation period. We conjecture that the seemingly unaffiliated are susceptible to conflicts of interest.

In both Table 1 and Table 2, abnormal patterns in the acts of recommendation issuance can be seen during the interim period between the announcement and effective dates. What is shown in Figure 3 is an extraordinary number of 4,269 recommendations issued on a single day right before the regulations took effect. This is in stark contrast to an average number of 115 recommendations per day during our sample period of 3,228 days. In Table 3, we analyze such an abnormal pattern in detail.

Figure 3: Daily Total Number of Recommendations

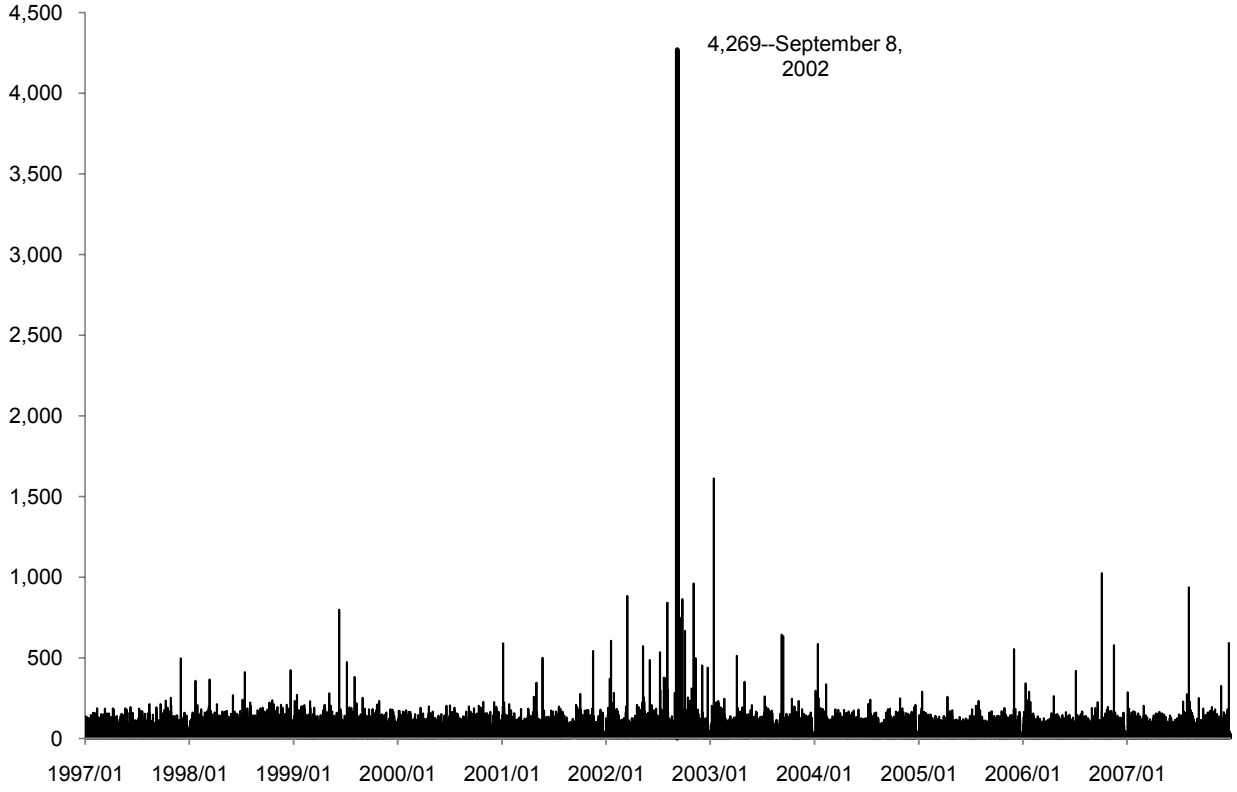


Figure 4 shows a large number of 4,269 recommendations issued on September 8, 2002 immediately before the effective date of rules. However, the average daily number of recommendations is only 115 during this 11-year sample period. These firms changed their rating systems as a response to the requirement of the buy/hold/sell distribution disclosure. The respective numbers of recommendations by their report contributors are as follow: 739 by BEAR; 1,080 by FBOSTON; 13 by GARANTIA; 1,393 by MERRILL; and 1,040 by SMITH, where FBOSTON and GARANTIA are both affiliated members of Credit Suisse.

Table 2 shows that the seemingly unaffiliated analysts provide significantly optimistic recommendations in both Pre- and Post-reg periods, but are not significantly optimistic during the interim period. In Panel A of Table 3, we classify the affiliated and seemingly unaffiliated recommendations under the affiliation category, and compare their optimism with clearly unaffiliated recommendations under the non-affiliation category. The percentages of *buy/hold/sell* in Table 3 show that 42% were issued *hold* on this special day to meet the requirement of the ratings distribution disclosure. However, only 29.7% offered relatively neutral recommendations on their clients, while the majority, 62.7%, still recommended *buy*. In contrast, only 38.5% of the unaffiliated recommendations said *buy*. On the other hand, only 7.6% of the affiliation recommendations said *sell* on their clients, whereas 17.7% of the unaffiliated analysts recommended *sell*. In Panels B and C, we observe the affiliated and seemingly unaffiliated recommendations separately. The evidence shows the disproportion of *buy* rating: 66.1% of affiliated analysts recommended their direct clients and 54.7% of seemingly unaffiliated analysts recommended their counterparts' clients. The seemingly unaffiliated recommendations are not as disproportionate as the affiliated ones, but are still more optimistic than unaffiliated ones on this day. Overall, the ratings reveal significant inequality between affiliation and non-affiliation groups in the Wilcoxon Rank Sums

and Kolmogorov-Smirnov two sample tests.

This analysis is consistent with our conjecture that the affiliated analysts avoid providing pessimistic or neutral recommendations on their clients, and disproportionately issued more unfavorable recommendations for unaffiliated firms than affiliated firms even on this special day. These recommendations were issued by six brokerage firms, with both FBOSTON and GARANTIA being affiliated members of Credit Suisse. They collectively picked this *special* Sunday for carrying out the adjustment of rating system. This strategic move is also what particularly propels us to consider a seemingly unaffiliated relationship. In Table 4, it is shown that the average ratings of recommendations issued by seemingly unaffiliated analysts are more pessimistic than those by unaffiliated analysts without significance prior to the announcement date of M&A events in Panel A. Accompanying the M&A's announcement, the average ratings are biased towards optimism, especially seen in target analysts providing recommendations on the acquirer's clients in Panel C. The average value is equal to 1.5 in the interim period on those seemingly unaffiliated recommendations provided by target firms' analysts.

Table 3: Analyst Recommendations Issued on September 8, 2002

Recommendation			Affiliation (a)		Non-affiliation (b)		Ratio	Difference in
Type	N	%	N	%	N	%	(a) / (b)	%
Panel A. Full Sample								
Strong Buy and Buy	1,777	41.6%	347	62.7%	1,430	38.5%	1.63	24%
Hold	1,794	42.0%	164	29.7%	1,630	43.9%	0.68	-14%
Underperform and Sell	698	16.4%	42	7.6%	656	17.7%	0.43	-10%
Subtotal	4,269	100.0%	553	100.0%	3,716	100.0%		
Test for equality		Wilcoxon (Rank Sums)			Kolmogorov-Smirnov			
of ratings			Z	-10.79	KS	0.0815	D	0.2427
between two samples:			P-Value	0.0000	KSa	5.3241	P-Value	0.0000
Panel B. Affiliated vs. unaffiliated								
Strong Buy and Buy	1,689	41.1%	259	66.1%	1,430	38.5%	1.72	28%
Hold	1,743	42.4%	113	28.8%	1,630	43.9%	0.66	-15%
Underperform and Sell	676	16.5%	20	5.1%	656	17.7%	0.29	-13%
Subtotal	4,108	100.0%	392	100.0%	3,716	100.0%		
Test for equality		Wilcoxon (Rank Sums)			Kolmogorov-Smirnov			
of ratings			Z	-10.77	KS	0.0811	D	0.2759
between two samples:			P-Value	0.0000	KSa	5.1952	P-Value	0.0000
Panel C. Seemingly unaffiliated vs. unaffiliated								
Strong Buy and Buy	1,518	39.2%	88	54.7%	1,430	38.5%	1.42	16%
Hold	1,681	43.4%	51	31.7%	1,630	43.9%	0.72	-12%
Underperform and Sell	678	17.5%	22	13.7%	656	17.7%	0.77	-4%
Subtotal	3,877	100.0%	161	100.0%	3,716	100.0%		
Test for equality		Wilcoxon (Rank Sums)			Kolmogorov-Smirnov			
of ratings			Z	-3.67	KS	0.0323	D	0.1618
between two samples:			P-Value	0.0001	KSa	2.0095	P-Value	0.0006

This table shows relatively neutral ratings on September 8, 2002. Affiliated and seemingly unaffiliated analysts issue a higher percentage of optimistic ratings, and unaffiliated recommendations have a higher percentage of pessimistic ratings.

On the other hand, the mean is 1.89 on recommendations provided by acquirer analysts on their target's clients in the interim period, and there is no difference in comparison with unaffiliated recommendations at a 10% significance level. The sample size of the acquirer recommendation is smaller than that of the target recommendation because target firms may have less underwriting business or because they are originally just pure brokerage firms. Another explanation is that during this period, the firms have not yet influenced their own analysts to favorably recommend their target firms clients. During these two later periods, the average value of recommendations provided by acquirer analysts on the target's clients is significantly more favorable than that of unaffiliated recommendations in Panel C. The optimism in

seemingly unaffiliated analysts appears to gradually decrease following the M&A's effective date but is still more optimistic than unaffiliated recommendations at 1% significance level in the three Panels. These results support Hypotheses 3a and 3b; seemingly unaffiliated analysts issue more optimistic recommendations on their counterparts' clients than on those by unaffiliated analysts during the M&A process stages. Interestingly, as an M&A starts to take effect over a longer period, this over-optimism is gradually checked. It may be because this affiliation relationship is then a well-known fact. We conclude that in the last stage, their behavior pattern is almost identical to that of the obviously affiliated, and conflicts of interest are seen to have the greatest influences at the time between the announcement and effective dates of M&A. It is arguably a loophole in the enactment of the regulations.

Table 4: Seemingly unaffiliated Analysts: acquirer and target recommendations for counterpart's clients

Variable	N	Mean					P-Value	
		Seemingly unaffiliated	Unaffiliated	Difference	Std Dev	t-stat	t	Z
Panel A. Full Sample								
Pre-M&A Announcement	412	1.9175	1.8932	0.0243	0.9887	0.50	0.3093	0.3936
AnnEff	152	1.5921	1.8487	-0.2566***	0.9314	-3.40	0.0004	0.0005
Post-M&A Eff within 1 yr	491	1.7251	1.8860	-0.1609***	0.9458	-3.77	0.0001	0.0001
Post-M&A Eff > 1 yr	2,592	2.0436	2.2238	-0.1802***	1.1464	-8.00	0.0000	0.0000
Panel B. Acquirer								
Pre-M&A Announcement	154	1.8312	1.9805	-0.1494**	1.0212	-1.81	0.0358	0.0303
AnnEff	36	1.8889	1.9167	-0.0278	0.9706	-0.17	0.4323	0.4360
Post-M&A Eff within 1 yr	80	1.6875	1.8750	-0.1875**	0.9820	-1.71	0.0458	0.0605
Post-M&A Eff > 1 yr	549	2.2240	2.3607	-0.1366***	1.2178	-2.63	0.0044	0.0025
Panel C. Target								
Pre-M&A Announcement	258	1.9690	1.8411	0.1279**	0.9558	2.15	0.0163	0.0240
AnnEff	116	1.5000	1.8276	-0.3276***	0.9115	-3.87	0.0001	0.0001
Post-M&A Eff within 1 yr	411	1.7324	1.8881	-0.1557***	0.9397	-3.36	0.0004	0.0004
Post-M&A Eff > 1 yr	2,043	1.9951	2.1870	-0.1919***	1.1264	-7.70	0.0000	0.0000

*In this table, Pre-M&A Announcement indicates the recommendations are made before the M&A announcement on their counterpart's clients; AnnEff indicates the recommendations are made during the interim period from announcement to effective dates; Post-M&A Eff within 1 yr indicates the recommendations are made after the effective dates within one year. Post-M&A Eff > 1 yr indicates the recommendations are made after the effective dates over one year. This table shows the average ratings of recommendations issued by seemingly unaffiliated analysts are pessimistic prior to the announcement date of M&A events in Panel A and Panel C. The optimism of target firms' analysts appears in the interim period from announcement to effective dates and gradually decreases as the M&A goes into effect. The symbols ***, **, * denote significance levels of 1%, 5% and 10%, respectively, for the one-tailed test in which the mean equals zero.*

CONCLUSION

This paper identifies a group of seemingly unaffiliated recommendations for which the contributors are not the underwriters but the acquirer or target firms of the underwriters. After investigating these relationships and refining the definition of affiliated recommendations, we examine the average rating difference between seemingly unaffiliated and unaffiliated recommendations as well as that between affiliated and unaffiliated recommendations. We find the average level increases toward a *hold* rating following the implementation of research analyst conflict of interest rules, but the seemingly unaffiliated analysts linked with either a lead or co-manager underwriting relationship provide significantly more optimistic recommendations than unaffiliated analysts. This stands true even in the post-regulation period, which shows that the rules do not effectively control this type of latent conflict of interest. The bias was especially blatant in year 2003. Turning to the affiliated analysts, we document the near disappearance of this type of over-optimism in 2004, and in 2007, affiliated analysts were even more pessimistic than unaffiliated analysts were. However, as we extend our empirical sample to cover the five years following the enactment of the rules, they appear to be significantly more optimistic than the unaffiliated analysts at 1% significance level. This result is inconsistent with Kadan et al. (2009), who conclude that the impact of affiliation on optimistic recommendations is no longer significant in the

post-regulation period. The contrast in our results may be accounted for due to our differences in research design, or simply due to the fact that their empirical period only extends to 2004. Moreover, our results show that the over-optimism of the lead affiliated analysts is more effectively under control than that of the co-manager affiliated analysts.

Through analyzing the rating distribution immediately before the effective date of the rules, we find that analysts disproportionately provide more unfavorable recommendations for unaffiliated firms than affiliated firms. On this single day, the *hold* rating had a total 42% share, but for the affiliated recommendations, the *hold* rating was merely 29.7% and the optimistic rating was 62.7%. The evidence shows the disproportion of buy rating: 66.1% of affiliated analysts recommended their clients and 54.7% of seemingly unaffiliated analysts recommended their counterparts' clients. The seemingly unaffiliated recommendations are not as disproportionate as affiliated ones, but are still more optimistic than unaffiliated ones on this day.

By designating a seemingly unaffiliated group, we attempt to shed light on the dynamics of strategic bias in different stages during the process of M&A. The evidence shows that: (a) before the announcement date there is no significant level of optimism; (b) the smallest average value among the four sample groups is seen during the interim period in the seemingly unaffiliated recommendations, provided by target firms' analysts who cover the clients of their acquirers, while during the same period the acquirer firms' analysts do not show a significant level of optimism in covering their target clients compared to the unaffiliated; (c) this degree of optimism turns slightly moderate following the effective date, but is still significant.

This seemingly unaffiliated relationship becomes clearly transparent after the effective date of an M&A, and during the last stage, the behavior of the seemingly unaffiliated analysts is almost identical to that of the obviously affiliated. Further, we observe the pinnacle of the influences brought by conflicts of interests in the interim period between the announcement and effective dates of M&A. This is understood as a reflection of strategic bias since there are no significantly positive biases before the announcement.

We conclude that strategic bias may be under the control of the rules, but is not thoroughly rooted out, and it rises to prominence especially when its existence is not known and its maneuver or orchestration does not spur or attract due attention. In sum, the strategic bias that compromises research neutrality and objectivity still taints analyst recommendations with unduly optimism and distortions when their affiliation status and conflicts of interest are less exposed.

Our research design combines both IPO and SEO offerings while also including both pre- and post-offering recommendations. To consolidate our research results, one area of future work is to include in our research framework the variables of the proceeds amount and gross spreads in these equity offerings and calculate the revenue from underwriting. Moreover, we can analyze levels of bias in different types of acquisitions for our future research, such as in an acquisition of majority interest and/or an acquisition of partial interest.

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CONVERTIBLE BOND DESIGN AND LONG-RUN OPERATING PERFORMANCE

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ABSTRACT

This paper examines the influence of bond design on the long-run operating performance of convertible bond issuers and the determinants of this performance. Bonds are classified as equity-like and debt-like according to their probability of conversion at the time of the issue. The measure of long-run operating performance is the pre-tax cash flows of the firm. The results show that in the three years before the offering equity-like convertibles have better performance than debt-like convertibles while the performance in the three years after the offering is similar for the two groups of firms. The results also show that the factors that determine the long-run operating performance of equity-like and debt-like offerings are different. For example, the rating of the bond issued has a more positive influence on the performance of equity-like issues compared to debt-like issues. The level of information asymmetry, on the other hand, has a more negative influence on the performance of equity-like issues. The study contributes to the literature by incorporating convertible bond design into the study of the long-run operating performance of these bonds.

JEL: G31, G32

KEYWORDS: Convertible bonds, long-run performance; operating performance; bond design

INTRODUCTION

There are several studies that examine the long-run operating performance of convertible bond issues. Typically, these studies find the average performance of all the convertible bonds in their sample. The underlying assumption of this approach is that the performance of convertible bonds does not change according to how firms design the bonds. However, Lewis, Rogalski, and Seward (1999) show that firms can design convertible bonds to be more equity-like or debt-like. In fact, Lewis et al. (2003), and Abhyankar and Ho (2006) find that the stock performance of convertible bonds is significantly different for equity-like and debt-like convertibles. This study analyzes whether convertible bond design affects the operating performance of the issuers as well. The study tests whether the long-run operating performance is different for equity-like and debt-like convertibles. The study also tests whether the factors that affect the long-run operating performance of convertible bonds have different influences for equity-like and debt-like convertibles.

As in Lewis et al. (1999), the design of the bonds is measured with the risk-neutralized probability that the bond will be converted into equity. Equity-like convertibles are defined as those issues with the probability conversion higher than the sample median while issues with this probability below the sample median are classified as debt-like convertibles. Long-run operating performance is measured with the pre-tax cash flows standardized by the total assets of the firm. As an additional proxy, the industry-adjusted version of this measure is used where the industry median is deducted from the cash flows of the firm.

The sample consists of 186 convertible bond offerings made by industrial firms. The findings show that the operating performance of equity-like convertibles is better than the performance of debt-like convertibles in the three-years before the offering. This finding is consistent with the argument of Myers and Majluf (1984) that riskier securities are more likely to be overvalued at the offering than less-risky

securities. The performance is similar for equity-like and debt-like convertible issuers in the three years following the issue. The results also show that the factors that determine the long-run operating performance are different for these two groups. For example, the riskiness of the bond has a more positive influence on the performance of equity-like convertible bond issuers compared to the issuers of debt-like convertibles. Similarly, the level of information asymmetry about the firm's future prospects has more negative influence on the performance of equity-like convertible bond issuers.

The rest of this paper is organized as follows: Section 2 provides a review of the literature. Section 3 develops the hypotheses and Section 4 presents the results of the tests of these hypotheses. Section 5 concludes the paper.

LITERATURE REVIEW

Most papers on the long-run performance of convertible bond issuers focus on the stock performance of these firms. Hansen and Crutchley (1990), McLaughlin, Safieddine, and Vasudevan (1998a), Lee and Loughran (1998), Lewis, et al. (2001), and Bae, Jeong, Sun, and Tang (2002) are the few papers that study the long-run operating performance of convertible bond issuers.

Hansen and Crutchley (1990) study abnormal earnings of convertible bond issuers for four years beginning in the year of the issue. They define abnormal earnings as the change in earnings in excess of the change in expected earnings. Hansen and Crutchley find that convertible bond issuers experience significant declines in abnormal earnings following the issue. They also find that there is a positive relation between the amount of capital raised and earnings decline for convertible bond issuers.

In their study, McLaughlin et al. (1998a) study the operating performance of convertible bond issuers over a seven-year period around the offer year. They measure operating performance with the pre-tax cash flows. They find that the operating performance of convertible bond issuers improves before the offer but declines after the issue. McLaughlin et al. test the relation between the operating performance of the bonds and the firm- and issue-characteristics. They find that the change in operating performance following the issue is negatively related to the operating performance prior to the offer, investment in property, plant and equipment, and prior equity issuance. They also find that the change in operating performance is positively related to the leverage ratio and the callability of the bonds.

Lee and Loughran (1998) also find that the operating performance of convertible bond issuers decline following the offering. Lee and Loughran use profit margin and return on assets as their metrics of operating performance and study a six-year period beginning two years before the offering and ending four years after the offering. They find that the operating performance is flat in the period before the offering.

Lewis et al. (2001) find that both cash flow operating performance (measured by operating income before depreciation divided by the total assets, profit margin, and return on assets) and investment operating performance (measured by capital expenditures and R&D expenses divided by the total assets and market-to-book ratio) of convertible bond issuers deteriorate after the issue. Analysts are surprised by the poor post-issue operating performance and adjust their growth estimates gradually. Lewis et al. argue that the decrease in profitability of convertible bond issuers is related to industry conditions and the capital expenditures of issuers revert back to industry levels after the funding requirements are fulfilled.

Bae et al. (2002) measure operating performance by the return on assets and show that in the one, three, and five years before the offering convertible bond issuers have positive abnormal operating performance. In the year of issuance the operating performance of convertible bond issuers is negative, suggesting that the decline in performance starts even before the bond are issued. The abnormal operating performance

in the one, three, and five years after the offering are negative. The results also show that larger issues result in worse operating performance in the issuing year and that the post issue operating performance is positively related to the stock price reaction at issue announcement.

HYPOTHESES

This section develops the hypotheses tested in the paper. First, the hypotheses on the long-run operating performance of equity-like and debt-like convertible issuers are presented. Next, the hypotheses related to the influence of convertible bond design on the relationship between issue- and firm-specific factors and the long-run operating performance of convertible bond issuers is presented.

Long-run Operating Performance of Equity-like and Debt-like Convertible Bonds

Myers and Majluf (1984) argue that riskier securities are more likely to be overvalued at the offering than less-risky securities. Hence, since equity is a more risky security than debt, the pre-issue operating performance of equity issuers should be better than the operating performance of debt issuers. Similarly, since equity-like convertibles have more equity characteristics we would expect these bonds to have better operating performance than debt-like convertibles during the period before the offering.

The argument of Myers and Majluf (1984) also suggest that following the offering, the superior performance of equity issuers should be reversed and the performance of equity issuers should be worse than the performance of debt issuers. Consistent with this argument Bae et al. (2002) show that equity issuers have negative long-run returns while straight bondholders have insignificant returns. Contrary to this finding, Hansen and Crutchley (1990) and McLaughlin et al. (1998b) show that both straight bonds issuers and equity issuers have negative long-run operating performance. This finding suggests that the performance of equity-like and debt-like convertible bond issuers could have similar performances in the long-run.

Determinants of Long-term Operating Performance of Equity-like and Debt-like Convertible Bonds

Prior literature shows that several firm and issue-related factors affect the long-run operating performance of convertible bond issuers. However, studies suggest that the design of convertibles could affect the extent of the influences of these variables since the design of the bonds determine whether the bonds behave more like equity or debt. Therefore, in the analysis of issue- and firm-specific factors, the study includes interactions with the convertible bond design.

Issue size: Miller and Rock (1985) suggest unexpected financing signals a decrease in future cash flows. Hence, the amount of capital raised should have a negative effect on the long-run operating performance since higher amounts of financing indicates that the firm will lower future cash flows. In Myers and Majluf (1984), overvaluation is higher for riskier securities. Hence, when firms issue equity-like convertibles (a riskier security) as opposed to debt-like convertibles, higher amounts of financing should result in even lower future performance.

Leverage and bond risk: Stein (1992) argues that convertible bondholders have lower credit quality and higher amounts of debt indicating that firms that are of better quality than what their rating and leverage imply have to issue convertible bonds rather than straight bonds. Hence, to the extent that convertible bond issues with low bond rating and high leverage are good quality, operating performance should be negatively related to bond rating and positively related to leverage. This relation should be more pronounced for debt-like convertibles since it is likely that firms that cannot issue straight bonds design the convertibles to be more like straight bonds. In a similar vein, for equity-like convertibles operating

performance should be less negatively (i.e. more positively) related to rating and less positively (i.e. more negatively) related to leverage.

Growth opportunities: McLaughlin et al. (1998b) indicate that firms with better growth opportunities may choose to issue convertible bonds instead of straight bonds when they have higher expected costs of financial distress and information asymmetry. These firms can obtain financing with lower yields since the option to convert these securities into equity makes convertibles attractive to investors. Hence, convertible bond issues with high growth opportunities at the time of issue will have better operating performance in the long-run. Convertible bond issuers that wished to issue straight debt if they did not have the financial distress and information asymmetry problems will design the issue to be debt-like. Therefore, the relation between operating performance and growth opportunities will be more positive for debt-like convertibles and less positive for equity-like convertibles.

Information asymmetry: McLaughlin et al. (1998b) find that debt and equity issuers with higher information asymmetry have higher declines in operating performance following the security issue and the decline for equity-issuers is higher. Hence, information asymmetry should have negative influence on operating performance and the influence should be more negative for equity-like convertibles.

Investments: McLaughlin et al. (1998a) argue that firms that make investments that increase firm value should have better operating performance. Since these investments are important for both equity-like and debt-like convertibles, both groups of firms should have a positive relation between investments and operating performance and should not expect a significant difference in the relation of this variable with operating performance of the two groups.

Announcement Returns: Bae et al. (2002) argue that the market can predict the long-run operating performance of security issuers when the security issue is announced, before the actual bond issuance. This argument suggests that announcement returns should be positively related to operating performance. This variable should not have a significantly different relation with the operating performance of equity-like and debt-like convertible bond issuers.

EMPIRICAL ANALYSIS

Measures of Convertible Bond Design and Operating Performance

In order to compare the long-run operating performance of equity-like and debt-like convertible issuers, the sample is divided into equity-like and debt-like convertibles using the probability of conversion measure in Lewis et al. (1999). In Lewis et al. probability of conversion is defined as the risk-neutralized probability that the bond will be converted into equity. Hull (1999) indicates that $N(d_2)$ in the option pricing equation is the cumulative probability under the standard normal distribution and represents the probability that the option will be exercised in a risk-neutral world. We estimate d_2 using the equation

$$d_2 = \frac{\ln(S/X) + (r - div - \sigma^2/2)T}{\sigma\sqrt{T}} \quad (1)$$

In this equation S is the issue date stock price, X is the conversion price, r is the risk-free rate calculated as the continuously compounded annual yield on 10-year T-bonds in the issue month, *div* is the continuously compounded dividend yield during the fiscal year preceding the issue date, σ is the standard deviation of the continuously compounded equity return estimated over the period 240 to 40 trading days prior to the issue date, and T is the number of years until maturity. Issues with probability of

conversion higher than the sample median are defined as equity-like convertibles and issues with probability of conversion lower than the sample median are defined as debt-like convertibles.

Operating Performance Measures

As in McLaughlin et al. (1998a), Alderson and Berker (2000), Lewis et al. (2001), and Hertzel, Lemmon, and Rees (2002) operating performance is defined as the pre-tax operating cash flows defined as the operating income before depreciation and amortization (Compustat item 13) adjusted by the book value of total assets (Compustat item 6). Pre-tax operating cash flow is a better measure of operating performance than earnings for two reasons. First, items such as income taxes, interest expense, and special items are included in earnings and these items obscure operating performance (McLaughlin et al. (1998a)). Second, this measure is a pre-tax measure and therefore is not affected by the changes in the firms' capital structure and tax status. Hence, pre-tax operating cash flow shows the economic benefits generated by the firm (Barber and Lyon (1996)). In order to be able to compare the cash flows through time and across firms, this measure is scaled with total assets.

As an alternative, operating performance is defined as the abnormal operating performance of the firm measured by the industry-adjusted performance since Barber and Lyon (1996) state that measuring operating performance as the firm's performance relative to the industry leads to well specified and powerful models. Industry-adjusted cash flow is the firm's pre-tax operating cash flow divided by total assets minus the median of this ratio for all firms in Compustat with the same two-digit SIC code. Operating performance is examined over a seven year period around the offer year (years -3 to +3). In a separate analysis, the pre-and post-issue changes in operating performance relative to year -1 is analyzed.

Data and Results

The sample consists of completed convertible bond issues made between 1992 and 2004 in US markets by industrial firms. D'Mello, Tawatnuntachai, and Yaman (2003) classifies firms with two-digit SIC codes of 49 as utilities, those with one-digit SIC code of 6 as financial institutions, and all other firms with valid SIC codes as industrial firms. The study follows this classification to define industrial firms. The initial sample of convertible bond issues is obtained from the Securities Data Corporation (SDC) database of Thomson Financial. All of the sample firms have balance sheet and income statement data in Compustat and common stock and price data in CRSP.

Table 1: Annual Distribution of Sample Firms

Year	All Convertibles		Equity-like Convertibles		Debt-like Convertibles	
	Number of	Number of	Number of	Number of	Number of	Number of
1992	34	34	22	22	12	12
1993	33	34	15	15	18	19
1994	11	11	7	7	4	4
1995	6	6	6	6	0	0
1996	17	18	13	14	4	4
1997	11	11	8	8	3	3
1998	10	10	8	8	2	2
1999	9	9	4	4	5	5
2000	11	13	3	3	8	10
2001	20	20	3	3	17	17
2002	3	4	0	0	3	4
2003	9	10	1	1	8	9
2004	6	6	2	2	4	4
Total	155	186	84	93	77	93

This table presents the annual distribution of sample firms and issues during the sample period. Equity-like Convertibles are issues with probability of conversion above sample median and Debt-like Convertibles are issues with this probability below the sample median. The sample of convertible bonds is obtained from the SDC database.

Table 1 presents the annual distribution of the firms and issues in our sample. There are a total of 186 convertible bond issues made by 155 firms in our sample. The total number of issues varies over the sample period. The highest number of issues was in 1992 (34 issues) and the lowest number of issues was in 2002 (4 issues). The total number of equity-like and debt-like issues in the sample is 93 each. Equity-like issues are clustered in the first few years of the sample period with 69% of the issues made in the first five years of the thirteen-year sample period. Debt-like issues are more evenly distributed with 42% of the issues made in the first seven years of the sample period. The highest number of equity-like issues was in 1992 (22 issues) and debt-like issues in 1993 (19 issues). There were no equity-like issues in 2002 and no debt-like issues in 1995.

Table 2: Sample Characteristics and Pre-issue Performance

Panel A: Issue- and Firm Characteristics

Variables	All Convertibles	Equity-like Convertibles	Debt-like Convertibles	Difference Equity-like - Debt-like
Total assets	8636.2100 (652.4400)	2429.1030 (531.1000)	14843.3200 (848.3700)	0.0505 * (0.1068)
Market Value of Equity	3841.6920 (875.8350)	2239.5090 (543.2700)	5443.8740 (1109.7200)	0.0034 *** (0.0137 **)
Issue Size	286.0903 (130.9500)	205.0527 (100.0000)	367.1280 (175.0000)	0.0143 ** (0.0163 **)
Standardized Issue Size	0.3235 (0.1993)	0.3013 (0.2207)	0.3457 (0.1769)	0.4079 (0.4217)
Debt Ratio (%)	26.0075 (25.5600)	26.9291 (28.2600)	25.0858 (22.8100)	0.5732 (0.3134)
Market-to-Book Ratio	3.5873 (2.5750)	3.1191 (2.5100)	4.0554 (2.7400)	0.1248 (0.3601)
Standardized Property	0.4699 (0.3668)	0.5467 (0.4047)	0.3932 (0.3625)	0.0157 ** (0.0569 **)
Probability of Conversion	0.2055 (0.1948)	0.3087 (0.2854)	0.1024 (0.1106)	<0.0001 *** (<0.0001 ***)
Call protection period	4.5209 (4.0000)	4.0031 (3.0000)	4.9943 (5.0000)	0.0449 ** (0.0485 **)
% Callable	12.90	11.83	13.98	
% Investment Grade	69.89	77.42	62.37	

Panel B: Pre-issue Operating Performance

Variables	All Convertibles	Equity-like Convertibles	Debt-like Convertibles	Difference Equity-like- Debt-like
Raw Operating Performance (-3)	0.0910 *** (0.1111 ***)	0.1279 *** (0.1285 ***)	0.0549 [b] (0.1044 ***)	0.0033 *** (0.0329 **)
Raw Operating Performance (-2)	0.0960 *** (0.1120 ***)	0.1372 *** (0.1327 ***)	0.0548 [c] (0.0907 ***)	0.0075 *** (0.0052 ***)
Raw Operating Performance (-1)	0.1029 *** (0.1113 ***)	0.1322 *** (0.1323 ***)	0.0735 *** (0.0956 ***)	0.0008 *** (0.0025 ***)
Industry-adjusted Operating Performance (-3)	-0.0677 * (-0.0091)	-0.0205 (0.0023)	-0.0884 * (-0.0091)	0.2495 (0.9740)
Industry-adjusted Operating Performance (-2)	-0.0392 (0.0038)	-0.0159 (-0.0064)	-0.0496 (0.0082)	0.6566 (0.6990)
Industry-adjusted Operating Performance (-1)	-0.0070 (0.0172 **)	0.01855 (0.03445 **)	-0.0205 (0.0154)	0.2289 (0.4666)

Panel C: Announcement Period Returns

Variables	All Convertibles	Equity-like Convertibles	Debt-like Convertibles	Difference Equity-like- Debt-like
CAR(-5,+5)	-0.0137 * (-0.0155 ***)	-0.0131 (-0.0096)	-0.0144 (-0.0168 **)	0.9370 (0.6674)
CAR(-3,+3)	-0.0129 ** (-0.0130 **)	-0.0107 (-0.0125)	-0.0151 (-0.0138 *)	0.7302 (0.6446)
CAR(-1,+1)	-0.0144 *** (-0.0171 ***)	-0.0123 *** (-0.0122 **)	-0.0165 * (-0.0254 ***)	0.6663 (0.3038)
CAR(-1,0)	-0.0116 *** (-0.0074 **)	-0.0099 ** (-0.0036)	-0.0133 ** (-0.0160 **)	0.6535 (0.5349)
CAR(0,+1)	-0.0087 *** (-0.0044 ***)	-0.0078 ** (-0.0040 **)	-0.0095 ** (-0.0052 *)	0.7519 (0.8390)

*This table presents the firm and issue characteristics of the sample firms. Panel A shows the mean and median values of the issue and firm characteristics; Panel B shows the long-run operating performance of the sample firms; and Panel C shows the cumulative abnormal returns (CAR) of the issuing firms around the announcement period. The table uses t-test to test the significance of the means and sign test for the medians. The numbers in "Difference Equity-like – Debt-like" column represent p-values of t-tests (Wilcoxon tests) for the differences in means (medians) for the equity-like convertibles sample from those of the debt-like convertibles sample. ***, **, and * denote significance at 1, 5 and 10 percent levels respectively.*

Table 2 presents the statistics on the sample. Panel A shows the characteristics of the issues and firms in the sample. In this table, the size of the firm is measured with the book value of total assets and the market value of the firm. The average asset size of our sample firms is $ 8.6 billion while the average market value of equity is $ 3.8 billion. Consistent with Lewis et al. (2003) the results show that firms that issue debt-like convertibles are larger than firms that issue equity-like convertibles. For example, the median market value of equity of debt-like convertibles is twice as high as that of equity-like convertibles. The mean and median issue size of debt-like convertible bond issuers is also larger than the issue size of equity-like convertibles issuers. Issue size is the total proceeds raised from the issue. However, the standardized issue size measured by adjusting the total proceeds by the book value of total assets is similar for debt-like and equity-like convertible issuers.

In Panel A of Table 2, the leverage of the firm is measured with the debt ratio defined as the book value of long-term debt and debt in current liabilities divided by the book value of total assets. The median debt ratio is 25.56% in our sample and the differences in the mean and median debt ratios of debt-like and equity-like convertible bond issuers are not statistically significant. Growth opportunities of the firm is measured with the market-to-book ratio defined as the stock price of the firm multiplied by the companies' shares outstanding, divided by common equity. The average market-to-book ratio is 3.12 for equity-like convertible bond issuers and 4.06 for debt-like issuers. The differences in the mean and median ratios are not significant. As in McLaughlin et al. (1998a) the propensity of the firm to make investments is measured by the tangible fixed property investment of the firm standardized by the book value of total assets. Both the mean and median values of this ratio are higher for equity-like convertible bond issuers indicating that these firms are more inclined to make investments for future growth.

Panel A of Table 2 also shows the issue characteristics of the firm. The average probability of conversion, the measure of the extent of equity-like characteristics, is 20 % for the overall sample, 31% for equity-like convertibles and 10% for debt-like convertibles. The findings also show that the debt-like convertibles have significantly longer call protection period compared to equity-like convertibles. The average call protection period is about 5 years for debt-like convertibles and 4 years for equity-like convertibles. In addition, a higher percentage of debt-like convertibles are callable (14%) compared to equity-like convertibles (12%). On average, equity-like convertibles have a better bond ratings compared to debt-like convertibles. About 77% of equity-like issues are rated investment grade (BBB and above) by Standard and Poor's while only 62% of debt-like issuers received this rating.

Panel B of Table 2 presents the operating performance of the firms in our sample before issuing convertible bonds. The results show that the operating cash flows of the firms increased over the three years before the convertible bond issuance. For the whole sample, average operating cash flows were 9.1% of total assets three years before the issuance, 9.6% two years before the issuance and 10.3 % a year before the issuance. The mean and median operating performances of equity-like convertibles are significantly higher than the performance of debt-like convertibles in all of the three years prior to the issue. For example, in the year before the offering the average operating cash flows is 13.2% of the assets of equity-like convertible issuers and only 7.4% of the assets of debt-like convertible issuers. This finding is consistent with Myers and Majluf's (1984) argument that riskier securities are more overvalued at issuance. When the industry-adjusted cash flows is used to proxy for the operating performance, operating cash flows continue to increase in the three years prior to the offering for the firms in the sample. With this proxy, the operating performance of equity-like convertible issuers is still higher than the performance of debt-like convertibles. However, the difference in the mean and median performance of the two sub-samples is insignificant.

Panel C of Table 2 shows the cumulative abnormal returns around the announcements of the convertible bonds in the sample. Abnormal returns are calculated using the market model where the CRSP value-weighted index is used as a proxy for the market return. In the market model, beta is estimated over 240 days ending 11 days before day 0, where day 0 is the filing date of the issue with the Securities and Exchange Commission. As in Clark, Dunbar, and Kahle (2001) and Jegadeesh, Weinstein, and Welch (1993), the filing date is used as the announcement date because since 1985 the reporting of the actual announcement dates of the issues is infrequent in the Wall Street Journal (WSJ) and using the WSJ announcements results in significant data loss. Overall, the findings show that convertible bond issuers obtain significantly negative announcement returns. This result is consistent with Dann and Mikkelson (1984) and Eckbo (1986). For example for the (-1,+1) period, the average cumulative announcement return is -1.44% for the whole sample, -1.23% for equity-like convertible issuers, and -1.65% for the debt-like convertible issuers. The differences between the abnormal returns of equity-like and debt-like convertible bond issuers are not significant in any of the announcement periods.

Figure 1 presents the graphs of the operating performance of the firms in the sample in each of the three years following the convertible bond issue. Figure 1.1 presents the graphs for the whole sample and shows that the pre-tax cash flow is stable in the three years following the issue. The median cash flow is 11.34% of total assets in the year following the issue and increases to 11.45% three years after the offering. Industry-adjusted operating performance is similar to pre-issue levels. The median industry-adjusted cash flow is 0.34%, -1.55%, and -0.54% in the three years following the offering.

Figures 1.2 and 1.3 present the graphical representation of the operating performance of equity-like and debt-like convertibles separately. The graphs show that the operating performance of equity-like convertible issuers is better for that that of debt-like convertible issuers in each of the three years following the issues. The median ratio of pre-tax cash flow to total assets range between 12.31% and 13.70% for equity-like convertible issuers 8.57% and 9.47% for debt-like convertible issuers. The largest difference in the industry-adjusted performance of equity-like and debt-like issuers is in the first year following the issue. In the first year following the issue, the median industry-adjusted operating performance cash flows is positive (2.70%) for equity-like convertible issuers while the performance is negative (-2.08%) for debt-like convertible issuers. The median industry-adjusted cash flows is 0.69% and 0.03% of total assets for equity-like issuers and -2.93% and -1.03% for debt-like convertible issuers in the two and three years following the offering.

Figure 1: Annual Post-issue Operating Performance

Figure 1.1: Operating Performance of All Sample Firms

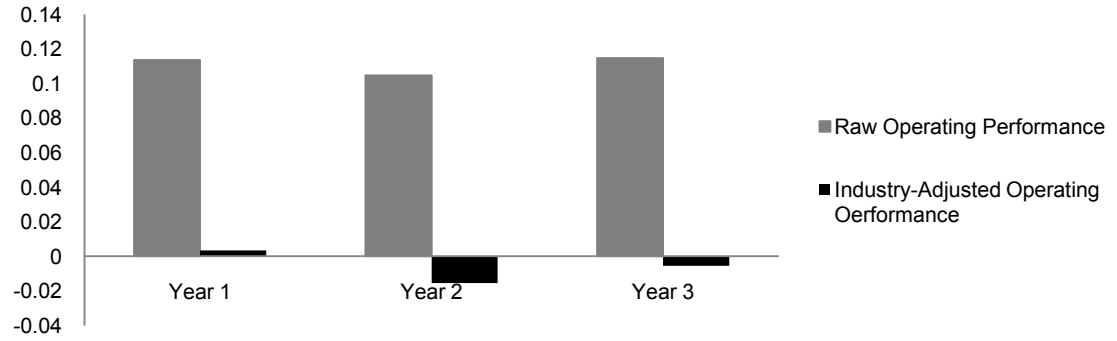


Figure 1.2: Raw Operating Performance of Issuers of Equity-like and Debt-like Convertibles

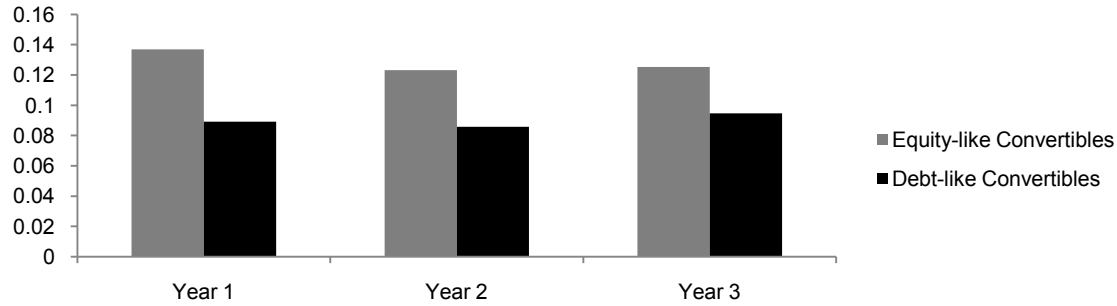
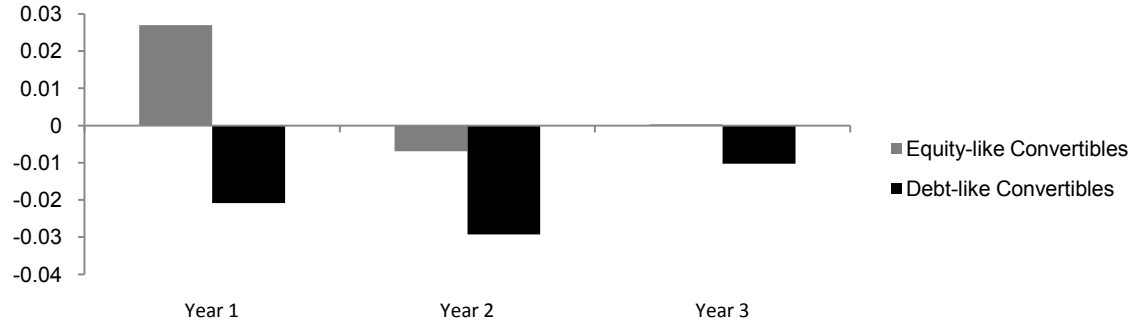


Figure 1.3: Industry-adjusted Operating Performance of Issuers of Equity-like and Debt-like Convertibles



This figure presents the median operating performance of the sample firms in each of the three years following the convertible bond issue. Raw operating performance is defined as the operating income before depreciation and amortization divided by the book value of total assets for years 1 to 3 relative to the issue year. Industry-adjusted operating performance is the raw operating performance of the firm minus the median raw operating performance in the issuing firm's industry for years 1 to 3.

Table 3 shows the operating performance of the sample firms in the three years following the offering compared to the year before the offering. The relative operating performance figures in this table show the percentage difference of the pre-tax cash flow in each of the three years following the issue from the pre-tax cash flow in the year prior to the offering. For the whole sample, the difference in performance is significant only in the second year following the issue. In this year both the mean and median operating performance are significantly lower than the performance in year -1.

Table 3: Univariate Comparisons of Long-run Operating Performance

Variables	All Convertibles	Equity-like	Debt-like	Difference Equity-
Relative Operating Performance (-1,+1)	-0.0428 (-0.0596)	-0.0247 (-0.0535)	-0.0619 (-0.0820)	0.6232 (0.6776)
Relative Operating Performance (-1,+2)	-0.0988 ** (-0.0667 *)	-0.0329 (-0.0447)	-0.1647 ** (-0.1590)	0.1496 (0.2075)
Relative Operating Performance (-1,+3)	-0.0315 (-0.0661)	0.0151 (-0.0449)	-0.0740 (-0.0661)	0.3686 (0.5461)
Industry-adjusted Relative Operating Performance (-1,+1)	-0.6029 *** (-0.5316 ***)	-0.5994 * (-0.4971)	-0.6048 *** (-0.5661 **)	0.9882 (0.7611)
Industry-adjusted Relative Operating Performance (-1,+2)	-0.8113 *** (-0.5650 ***)	-0.9326 ** (-0.8259 *)	-0.7614 ** (-0.4952 **)	0.7292 (0.4890)
Industry-adjusted Relative Operating Performance (-1,+3)	-0.5203 ** (-0.4586 ***)	-0.9934 ** (-0.9729 ***)	-0.3282 (-0.3892 **)	0.1581 (0.1235)

*This table presents operating performance of the sample firms in the three years following the issue compared to the performance in the year prior to the issue. The table uses t-test to test the significance of the means and sign test for the medians. The numbers in "Difference Equity-like – Debt-like" column represent p-values of t-tests (Wilcoxon tests) for the differences in means (medians) for the equity-like convertibles sample from those of the debt-like convertibles sample. ***, **, and * denote significance at 1, 5 and 10 percent levels respectively.*

The relative performance of equity-like convertible issuers does not change significantly in the three years following the offering compared to the year before the offering. For debt-like issuers the average operating performance is 16% lower than the year before the offering. However, in the first and third years after the offering the relative performance of debt-like convertible issuers does not change either. When the relative operating performance is used as our proxy, equity-like convertible issuers continue to perform better in each of the three years following the offering, although the difference in performances of equity-like and debt-like convertible issuers is not significant. In this table when operating performance is defined as the relative operating performance adjusted by the median relative performance in the firm's industry, performance is significant for the whole sample and the equity-like and bond-like convertible issuer sub-samples. The difference in performance is not significantly different for the two sub-samples with this proxy either. These findings are consistent with Hansen and Crutchley (1990) and McLaughlin et al. (1998b) who show that that both equity-like and debt-like convertible issuers have negative long-run performance.

Table 4 studies the determinants of the long-run operating performance of equity-like and debt-like convertibles. In the regressions in Tale 4, we use the following model:

$$OP = \beta_0 + \beta_1 IS + \beta_2(t*IS) + \beta_3 BR + \beta_4(t*BR) + \beta_5 MB + \beta_6(t*MB) + \beta_7 FS + \beta_8(t*FS) + \beta_9 DR + \beta_{10}(t*DR) + \beta_{11} PI + \beta_{12} AR \quad (2)$$

These regressions test the impact of convertible bond design on the influence of firm- and issue-related factors on operating performance by interacting a dummy variable (t) with the independent variables. The regressions include the variables as well as their interactions with the dummy variable that takes the value of one for equity-like convertibles and zero for debt-like convertibles. The coefficient of the interactive term shows the incremental influence of the independent variable for the equity-like convertibles compared to the debt-like convertibles while the coefficient of the independent variable shows the influence of the variable for debt-like convertibles.

Table 4: Determinants of Long-run Operating Performance

Variable	Operating Performance (-1,+3)			Operating Performance (-1,+1)		
	1	2	3	4	5	6
intercept	141.4680 (1.83)	13.0811 (0.21)	17.7803 (0.22)	40.7029 (0.62)	163.9008 (1.96)	-53.2822 (-0.93)
Standardized Issue Size	-129.1741 *** (-2.74)		-92.4502 * (-1.90)		-151.3624 *** (-2.78)	
Type * Standardized Issue Size	-124.4843 (-1.36)		-66.6086 (-0.79)		35.1461 (0.46)	
Bond Rating	-29.7558 (-0.77)	-20.7972 (-0.53)		-36.5375 (-0.82)	-47.7768 (-1.08)	
Type * Bond Rating	132.3776 ** (2.06)	144.7683 ** (2.15)		154.5145 ** (2.12)	166.6190 ** (2.31)	
Market-to-Book Ratio		-7.5050 * (-1.91)		-8.3596 * (-1.82)		
Type * Market-to-Book Ratio		-6.1395 (-0.67)		1.2223 (0.13)		
Market Value of Equity	-10.5312 (-1.20)	2.7122 (0.29)		0.5956 (0.06)	-11.3756 (-1.15)	
Type * Market Value of Equity	-3.3028 (-0.33)	-5.7805 (-0.51)		-5.4156 (-0.42)	-8.3385 (-0.73)	
Total Assets			-1.2521 (-0.14)			0.6192 (0.07)
Type * Total Assets			8.4133 * (1.85)			17.5048 ** (2.27)
Debt Ratio	-0.6506 (-0.64)	-0.2969 (-0.29)		-0.4488 (-0.38)	-0.8940 (-0.76)	0.5487 (0.45)
Type * Debt Ratio	-0.7203 (-0.54)	-0.8396 (-0.61)		-1.4998 (-0.99)	-1.5031 (-1.02)	-2.3702 (-1.44)
Standardized Property	-14.6733 (-0.45)		-7.4678 (-0.23)		-8.0530 (-0.22)	18.6908 (0.51)
Change in Stand. Property		62.6520 (0.59)		81.8257 (0.71)		
CAR(-1,0)	-295.8590 (-1.18)		-371.5125 (-1.46)		-128.7577 (-0.46)	
CAR(1,1)		-90.5134 (-0.46)		-94.6046 (-0.42)		-133.7757 (-0.59)
R^2	0.1384	0.1099	0.0982	0.0956	0.1165	0.0427
F-statistic	2.15 **	1.64 *	2.51 **	1.63 *	2.03 **	1.18
N	144	143	144	164	164	164

*This table presents OLS regressions of the determinants of the long-run operating performance of equity-like and debt-like convertible bonds. In regressions 1-3, the dependent variable is the percentage change in operating performance three years after the offering from the year before the offering. In regressions 4-6, the dependent variable is the percentage change in operating performance one year after the offering from the year before the offering. The first figure in each cell is the regression coefficient and the numbers in parentheses are t-statistics. ***, **, and * denote significance at 1, 5 and 10 percent levels respectively.*

In the regressions in Table 4, the dependent variable *OP* is the operating performance and is measured using two alternative methods. In the first three regressions, the dependent variable is the percentage change in the operating performance of the issuer in year 3 relative to year -1 while in the last three regressions dependent variable is the operating performance in year 1 relative to year -1. *IS* is the issue size and is defined as the total proceeds from the bond sale adjusted by total assets of the firm. As in

Jewell and Livingston (1997), the riskiness of the bonds is measured with the bond rating (*BR*). Bond rating is a dummy variable that takes the value of one for bonds rated investment grade (BBB or above) by Standard and Poor's and zero for bonds rated below investment grade or are unrated. As in Table 2, growth opportunities of the firm is measured with the market-to-book ratio (*MB*). *FS* is firm size and measures the information asymmetry between the company insiders and investors about the future prospects of the firm. As in D'Mello et al. (2003), the size of the firm is used as our measure of the level of information asymmetry because prior studies find that large firms have more information available to the public since they are more likely to be followed by analysts and the popular press. Hence, in general, small firms have more information asymmetry. Firm size is measured using two alternative proxies; market value of equity and the total assets of the firm.

In Table 4, *PI* is the level of property investment made by the firm. As an additional proxy, the change in the investments of the firm in the year of the issue compared to the investments in the year prior to the issue is used. Leverage is measured with the debt ratio (*DR*). As in Bae et al. (2002), the table also tests the influence of the announcement returns on operating performance. Announcement returns (*AR*) is defined as the cumulative abnormal returns accumulated over days (-1,0) and (-1,+1). Abnormal returns, debt ratio, and property investment are estimated using the same methods as in Table 2.

Table 4 shows that for debt-like convertible issues the issue size has a negative influence on the long-run operating performance. This finding is consistent with Miller and Rock (1985)'s argument that issuers of large offerings should have more negative performance. This finding is also consistent with Hansen and Crutchley (1990) who show that the amount of capital raised is negatively related to long-term operating performance. However, contrary to the arguments of Myers and Majluf (1984), for large offerings, equity-like convertible issuers do not obtain lower long-run performance compared to debt-like convertible bond issuers. The findings also show that the coefficient of the rating interactive variable is positive. This finding is consistent with our hypothesis that the influence of bond rating should have a more positive (less negative) influence on long-run performance of equity-like convertibles compared to debt-like convertibles. The results show that debt-like convertibles with high growth opportunities obtain lower long-run performance. The influence of growth opportunities is similar for equity-like and debt-like convertibles.

The results show that the coefficient of the interaction of the asset size with the bond design dummy is positive. This finding is consistent with the arguments of McLaughlin et al. (1998b). However, this variable has an insignificant coefficient when we use the market value of equity as our proxy for information asymmetry. Hence, the study finds only limited support for the hypothesis that the influence of information asymmetry (small firms) is more negative for equity-like convertibles. The findings show that leverage has similar influences on operating performances of debt-like and equity-like convertible issuers and the influences of property investment and announcement returns are insignificant.

CONCLUSIONS

This paper studies the impact of convertible bond design on the long-run operating performance of these bonds and the determinants of this performance. Convertible bonds with probability of conversion higher than the sample median are classified as "equity-like" and bonds with probability of conversion lower than the sample median are classified as "debt-like". Myers and Majluf (1984) suggest that equity-like convertible issuers should have better operating performance than debt-like convertible issuers before the offering. After the offering, the performance of the issuers of equity-like convertibles should deteriorate and be worse than the performance of the issuers of debt-like convertibles. Alternatively, Hansen and Crutchley (1990) and McLaughlin et al. (1998b) suggests that the performance of both equity-like and debt-like convertibles should be negative and similar to each other. Prior studies also suggest that convertible bond design affects the factors that determine the long-run operating performance of these

bonds. The factors that affect the performance of convertible bonds may be more or less influential for equity-like and debt-like convertibles.

The sample consists of 186 completed convertible bond issues offered by industrial firms in US markets between 1992 and 2004. The findings show that equity-like convertibles have better operating performance than debt-like convertibles in each of the three years before the offering. In the three years after the offering equity-like convertible bond issuers continue to perform better. However, the change in operating performance from the year before the issue is similar for equity-like and debt-like convertible issuers. The results also show that convertible bond design affects the influence of several factors on the long-run performance of these bonds. For example, the riskiness of the bond has a more positive impact on the long-run performance of equity-like convertible bond issuers compared to debt-like bond issuers while the influence of information asymmetry has a more negative influence.

This study points to the importance of controlling for security design in the analysis of the long-run operating performance of convertible bonds. However, the study does not study the impact of security design on other aspects of convertible bonds. Furthermore, the study also does not examine how the design of other securities affects their performance. Future studies should examine these issues. The study also analyzes only industrial firms. Future studies should include financial firms and utilities in their sample and study how the results differ for these different types of industries.

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ARE EMPIRICAL RESULTS IN ECONOMIC GROWTH MODELS BIASED BECAUSE OF OMITTED VARIABLES? CROSS-COUNTRY EVIDENCE

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ABSTRACT

This study examines the impact of external factors, such as law, regulation, and technology on a country's rate of economic growth. The results suggest that the technological, legal, and regulatory environment can play a major role towards enhancing the smooth functioning of the financial system and economic growth. While a growing body of evidence examines the individual impact of similar external factors, Demirguc-Kunt (2006) argues that it is crucial to consider all the relevant factors together in one model. Thus, this study first examines the individual impact of these external factors for both advanced and emerging countries. Next, we examine the joint impact of relevant factors selected by stepwise regression procedures. The findings provide evidence for both groups of countries that the best models for predicting economic growth are ones that do include all the relevant factors together in one model.

JEL: K00; G28; G21; O16; O11

KEYWORDS: Legal system, regulation, technology, financial development, economic growth.

INTRODUCTION

It appears that the technological, legal, and regulatory environment can play a major role in either enhancing or retarding the smooth functioning of a financial system. Levine (2004) summarizes the existing empirical literature and points out that various studies have examined the individual role of political, legal, regulatory, and geographic factors in shaping financial sector development (FSD) and economic growth. Moreover, Demirguc-Kunt (2006) argues that it is crucial to consider all the relevant factors together in one model. The relatively low adjusted R-squares reported by Odedokun (1996) and Liang and Reichert (2006) provide evidence that there are still important variables, which have not been included in economic growth model.

Recently, Levine (2004), Barth et al. (2004), and Demirguc-Kunt (2006) stress that whether a country's financial system can allocate resource efficiently is more important than arguing the ideal structure of the financial system. La Porta et al. (1997 and 1998) stress that a country's legal system has a crucial impact on economic growth. On the other hand, Dermiguc-Kunt and Maksimovic (2002) find that introducing proper financial regulations can compensate for a weak legal system. However, previous studies do not consider the nature of the financial system in terms of regulation and corporate governance in accessing their impact on economic growth. Therefore, this study includes a comprehensive set of regulatory factors (i.e. deposit insurance scheme, measures of competitive banking environment, ownership structure, and bank freedom) in a comprehensive growth model.

Furthermore, recently researchers stress the fact that rapid advances in information and communication technology (ICT) can have profound effects on reducing transaction costs and information asymmetry. Thus, the traditional role of financial intermediations as "delegated monitors" is no longer unique and ICT has become a key factor in transforming the role of financial intermediation in a modern economy. Recent studies by Stiroh (1999) and others suggest that ICT represents a "New Economy" which can stimulate widespread growth through improved information disclosure and increased productivity. However, while Stiroh (1999) empirically examines the relationship between ICT and economic growth he fails to control for regulatory and legal factors.

As indicated in the literature review below, different researchers have employed various measures of FSD with no one measure identified as the single correct specification. King and Levine (1993) criticize the sole reliance on liquidity (M3) as an insufficient measure of FSD and suggest four alternative measures: 1) bank deposits, 2) the relative size of bank assets to total real sector assets provided by bank and central banks, 3) bank assets divided by GDP, and 4) bank private credits provided by GDP. Since these alternative FSD measures are highly correlated, we employ principal component analysis to reduce the number of variables and avoid multicollinearity problems. In addition to a narrow measure of liquidity a complementary measure of FSD is included, which considers the four alternative measures mentioned above. The complementary FSD measures are limited to banking sector development and view the existence of other sectors, such as, the equity and derivative markets as driven by exogenous regulatory factors. That is, regulation determines whether a country allows for a stock or bond market, or other non-bank types of financial institutions as complementary or substitute tools for financial resource allocation.

Therefore, the main purpose of this study is as follows. First, this study separately examines the individual impact of various relevant external factors (i.e. legal, regulatory, and ICT factors) in an expanded economic growth model which including complementary measures of FSD. Second, by selecting and retaining statistically significant external factors using stepwise regression, the final model tests their individual and collective impact. The reminder of this paper is organized as follows. Section 2 reviews the prior literature on economic growth. Section 3 discusses the methodology and the empirical model. Section 4 presents the empirical findings, while Section 5 presents the conclusions.

LITERATURE REVIEW

It has long been recognized that banks play an important role in channeling saving to their most productive use, which in turn promotes economic growth. A good deal of the empirical literature focuses on whether causality runs from FSD to economic growth (supply-leading role) or whether the demand for FSD is a derived demand (demand-following). Thus, FSD can play a leading role in economic growth or it may take a more passive role in response to expanding economics needs. In an early paper, Patrick (1966) states that in the beginning stages of economic development, causation generally runs from economic development to FSD.

This "demand-following" view is often used to explain the lack of financial institutions in underdeveloped countries were there is a low demand for financial services. As economic growth occurs the direction of causality may reverse and a "supply-leading" relationship may develop. Here the efficiency gains associated with financial intermediation stimulate continued economic growth in the later stages of a county's economic growth cycle. Furthermore, expanded FSD can take place along a "financial sector broadening" dimension where consumers and firms, acting as both investors and borrowers, have more efficient access to basic intermediation services. Expanded access to financial services saves time and lowers transactions costs. To the extent that economies of scale exist, the development of large-scale financial intermediaries and markets drive information and transaction costs even lower.

Goldsmith (1969) is the first to examine the relationship between financial sector development and economic growth under the assumption that the size of the financial system is a proxy for the quality of financial services provided, and hence, has a positive impact on economic growth. However, Goldsmith's work does not systematically control for other potential factors which may also influence economic growth. Both King and Levine (1993) and Odedokun (1996) address this weakness by developing a model which includes other relevant factors. Levine's 1998 study develops a regression model to link banking sector development, as measured by loans issued by banks/GDP, and the legal environment, as measured by creditor rights and contract enforcement. However, Levine's study does not consider the effect of deposit insurance, bank regulation, and information technology simultaneously on economic growth. For example, the presence of excessive levels of deposit insurance might diminish the positive influence of banking sector development on economic growth by increasing the risk-taking activities of

households and firms, leading to a sub-optimal allocation of resources. In the same way, excessive regulations on banking activities might also reduce bank efficiency by limiting opportunities for economies of scale and scope and risk diversification. Using the same econometric approach, Levine (1999) expands his previous work to link financial sector development (FSD) and the legal system by using four alternative measures of FSD: 1) the ratio of liquid liabilities to GDP, 2) the ratio of bank assets to total bank and central banks assets, 3) bank credits /total domestic credits, and 4) bank private credits/GDP, and four measures for legal system: a) legal tradition, b) creditor rights, c) contract enforcement, and d) financial reporting. The results are similar to his earlier paper where legal and regulatory environment has a positive impact on FSD.

Odedokun (1996) points out many existing studies suffer from a biased estimator problem due to omitting relevant variables. Odedokun (1996) proposes a theoretical model, which allows the researcher to easily expand the precise definition of FSD and/or other external factors. Most of the empirical research focuses on the direct relation between FSD and economic growth. Indicators of FSD that have been used in the literature consist of broad measures of banking activity such as the provision of private credit (lending) and measure of liquidity, such as, M2 or M3. In addition, some studies go beyond the banking system and examine the role of the stock market in FSD. For example, the potential complementary or substitutability role between the banking sector and stock markets has been studied in the empirical studies (Liang and Reichert, 2007, and Levine, 1998). As mentioned above, countries with the same level of banking sector and stock market development may not attain the same level of economic growth because of different financial, legal, and regulatory structures. Recent research attempts to control for differences in the legal and social environment but additional work is needed in terms of the bank regulatory and supervisory environment.

DATA AND METHODOLOGY

The countries included in the analysis were selected using the classification employed in the IMF's 2005 World Economic Outlook report. The IMF divides the world into two major groups: advanced countries[1] and emerging/developing countries[2]. This study follows the World Bank definition and separates the countries into these two groups. The twenty advanced countries include: Canada, France, Japan, United States, Italy, Germany, Australia, Belgium, Denmark, Finland, Hong Kong, Iceland, Ireland, Israel, Korea, Netherlands, New Zealand, Norway, Sweden, and Switzerland. The seventy developing/emerging countries include: Algeria, Antigua and Barbuda, Argentina, Bangladesh, Benin, Bolivia, Botswana, Brazil, Burkina Faso, Chile, China, Colombia, Comoros, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'lvoire, Dominican Republic, Ecuador, Egypt, Arab Rep., Ethiopia, Gabon, Gambia, Ghana, Grenada, Guatemala, Honduras, Hungry, India, Indonesia, Iran, Jamaica, Jordan, Kenya, Lesotho, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mauritius, Mexico, Morocco, Mozambique, Nicaragua, Niger, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Rwanda, Senegal, South Africa, Sri Lanka, St. Lucia, St. Vincent and the Grenadines, Swaziland, Syrian Arab Republic, Thailand, Togo, Trinidad and Tobago, Tunisia, Uganda, Uruguay, Venezuela, Zambia, and Zimbabwe.

The data for this study is obtained from the following sources: 1) 2005 World Bank Economic indicators, 2) the Beck and Levine 2002 data set, 3) the Beck et. al. 2006 data set, 3) Economic Freedom of the World Index, and 4) Index of Economic Freedom. This study starts by employing an Odedokun-type (1996) economic growth model, which employs a neo-classical aggregate production model in which financial sector development (F_{it}) is one of several inputs in the production function. Then, by adding complementary FSD measures, the authors obtain an improved economic growth model using more comprehensive and precise FSD measures.

Complementary FSD Measures

The complementary FSD measures (FSD_{it}) are obtained using principal components analysis. The candidate components for FSD are shown in Table 1. The criteria for how many components to include

are a trade-off based on the Kaiser Criterion test (e.g., eigenvalues larger than one), the Cattell Screen test (e.g., ordered eigenvalues screen plots), and the degree of variability explained by these components (e.g., >90%).

External Factors

1) Legal factors: The authors expects a direct positive impact associated with the legal environment (e.g., legal system) on economic growth since the legal environment has a positive influence on the precise terms and availability of funds for borrowers. Legal system (LEGAL2) includes measures of judicial independence, impartial courts, protection of property rights, and freedom from political intervention.

2) Regulatory factors: First, deposit insurance protection can provide a stable financial environment and thus promote economic growth. On the other hand, excessive deposit insurance protection can also cause a negative impact on economic growth by promoting undue risk-taking behavior. Therefore, this study examines the net impact of deposit insurance on economic growth. Second, while market structure theory suggests that proper regulatory restrictions on banking activity can compensate for the negative impact of deposit insurance, it also might hinder economic growth by creating a less competitive banking environment. Efficiency theory on the other hand suggests that fewer restrictions on banking activities and market entry can enhance the competitive banking environment and promote economic growth through more efficient bank management and improved resource allocation. Third, government ownership of banks often hinders efficient resource allocation and slows economic growth. Finally, bank privatization, especially foreign ownership of banks in developing countries, improves bank management and can accelerate economic growth.

The following variables are designed to proxy for regulatory factors: (1) DEPOSITINS reflects the deposit insurance coverage amount measured as a percent of per capita GDP. The DEPOSITINS variable is included in the regression model to capture the continuous impact of deposit insurance on GDP growth, (2) bank concentration (BKCONCEN), net interest margin (NIM), and overhead costs (OHCOSTS) are designed to measure the degree of competitiveness in the banking sector. Restrictions on banking activities or entry can hinder FSD and economic growth. The expected sign for BKCONCEN is unclear: if market structure theory holds, a negative sign is expected; otherwise, a positive signs hold to support the efficient theory. Negative signs for NIM and OHCOSTS are expected, which shows the negative impact of a less-competitive baking environment on economic growth. (3) Privately owned banks (BKPRIVAT1) is a proxy for good corporate governance and efficient management and a positive sign is expected. (4) Foreign-entry (FGENTRY), as measured by the percentage of foreign owned banks, is expected to have a positive sign since it signals a competitive banking environment and accelerates technology transfers across borders, (5) the index of Bank and Commerce Freedom is designed to measure the overall regulatory environment since this index includes restrictions on banking activities, entry, and ownership. A higher score represents greater bank freedom but the expected sign is unclear since greater bank freedom may lead to efficient management and investments within banks but it may also increase imprudent risk-taking.

3) Technology factors: ICTs investment promotes economic growth by increasing productivity and lowering operating costs. In addition, ICTs can also accelerate FSD through efficient bank management and broader and timelier information disclosure. TECHEXP and TECHIMP, which measure the percentage of computer and communication service exports and imports respectively, are included to capture the direct impact of ICT development on economic growth.

The next step is to examine the impact of a vector of external factors in the economic growth model (Equation 1). A unit root test is employed to examine the stationarity of each continuous variable. When a unit root test shows that a variable is non-stationary in level form, the first difference is computed and a "D" is placed in front of the variable name. Initially, individual external factors are examined by including them one at a time in the model. These individual results can subsequently be compared with the full model that simultaneously includes all of the relevant external factors.

$$\dot{Y}_{it} = b_0 + b_1\dot{L}_{it} + b_2\left(I/Y\right)_{it} + b_3\dot{X}_{it} + b_4\dot{F}_{it} + b_5F\dot{S}DPC1_{it} + b_6F\dot{S}DPC2_{it} + b_7E_{it} + \mu_{it} \quad (1)$$

$\dot{Y}_{it}$ =Economic growth is measured as the annual growth rate of real GDP.
$\dot{L}_{it}$ =Labor force growth is proxied by population growth which was calculated as the annual rate of population growth.
$\left(I/Y\right)$ = The investment/GDP ratio is computed as gross nominal fixed capital formation divided by nominal GDP.
$\dot{X}_{it}$ =Real export growth is calculated as the annual rate of growth of exports of goods and services.
$\dot{F}_{it.}$ = Liquid liability growth is calculated as the annual growth rate of liquid liabilities (M3).
$FSDPC1_{it}$ = Represents the first principal component of complementary FSD measures
$F\dot{S}DPC2_{it}$ =Represents the second principal component of complementary FSD measures
E_{it} =a vector of 10 external exogenous factors: LEGAL2, DEPOSITINS, BKCONCEN, NIM, OHCOST, BKPRIVAT, FGENTRY, BKFREE, TECHIMP, and TECHEXP.
u_{it} = Normally distributed error term , i = a specific country, t = a specific year

Table 1: Definitions of Complementary Measure of FSD_{it} and External Factors

Variable Name	Definition /Time period/Source	Time period
Panel A		
DEPGDP*	Bank deposits divided by GDP /(1960-2005) Source: Beck et al. (2006)	1960-2005
BKLNCB*	Percentage of domestic non-financial real sector assets held by commercial banks (denominator: the total held by central banks and commercial banks). Source: Beck et al. (2006)	1960-2005
BKLNGDP*	Commercial banks claims on domestic non-financial real sector assets divided by GDP Source: Beck et al. (2006)	1960-2005
BKLNGDP2*	Private credits by deposit money bank to GDP Source: Beck et al. (2006)	1960-2005
Panel B		
LEGAL2**	Legal structure and security of property rights Source: Economic Freedom of the World	1970-2003
Panel C		
DEPOSITINS*	Coverage to GDP per capita ratio Source: World Bank Data	1960-2004
BKCONCEN*	The share of assets of the three largest banks in total banking system assets. Source: Beck et al. (2006)	1960-2005
NIM*	The value of a bank's net interest income as a share of its interesting-bearing assets Source: Beck et al. (2006)	1960-2005
OHCOSTS*	The accounting value of a bank's overhead cost as share of its total assets Source: Beck et al. (2006)	1960-2005
BKPRIVAT**	Ownership of Banks equals the percentage of deposits held in privately owned banks, measured in deciles. Source: Index of Economic Freedom	1970-2003
FGNENTRY**	Foreign banks' share of total banking sector assets measured in deciles. Source: Economic Freedom of the World	1995-2003
BKFREE***	Overall regulatory environment. Source: Index of Bank and Commercial Freedom	1995-2006
Panel D		
TECHEXP*	Computer, communications and other services (% of commercial service exports) Source: World Bank Data	1972-2004
TECHIMP*	Computer, communications and other services (% of commercial service imports) Source: World Bank Data	1972-2004

*This table shows the definitions, time period, and sources of complementary measures of FSD and external factors. Panel A defines the complementary measures of FSD variables. Panel B defines the legal factor. Panel C defines the regulatory factors. Panel D defines the technology factors, and. * continuous variable, ** a variable which is ranged from 1-10, and *** a variable which is ranged from 1-5.*

The results of the principal component analysis are available upon request from the authors. The first component, C1BK, is interpreted as an index of general banking sector development given its large

eigenvector loadings with DEPGDP, BKLNGDP, and BKLNGDP2. DEPGDP captures the deposit services provided by the banking sector, while BKLNGDP and BKLNGDP2 capture the effects of a bank lending activities. Thus, C1BK can be viewed as a measure of banking sector "broadening" in the sense that it measures the scale of traditional intermediation services. The second component, C2BK2, has high factor loadings on BKLNCB. Thus, C2BK2 can be interpreted as measuring the level of private sector intermediation as measured by the amount of financial capital provided by commercial banks relative to that provided by public sector central banks. Thus, C2BK2 can be viewed as measuring the "deepening" of the banking sector since commercial banks may provide more sophisticated risk management services and make more efficient capital allocation decisions than government run central banks. After obtaining scores for each of these five components, a unit root test was employed to examine the stationarity of each component. Both components (C1BK and C2BK2) were non-stationary in their levels and required first differencing which is indicated by placing a "D" in front of the component name [e.g., D(C1BK)].

Joint External Factors

The first four variables in equation 1 are control variables (L, I/Y, X, and F) and are forced into the stepwise regression model. Then a vector of complementary FSD measures and external factors are considered as candidates in the stepwise model. After the final external factor regressor set is determined by the stepwise procedure, the incremental contribution of these external factors is used to measure the impact of omitting relevant variables (Equation 2).

$$\begin{aligned} \dot{Y}_{it} = b_0 + b_1\dot{L}_{it} + b_2\left(I/Y\right)_{it} + b_3\dot{X}_{it} + b_4\dot{F}_{it} + \mu_{it} \quad & \text{(Forced regressors)} \\ + B_1\,F\dot{S}D_{it} + B_2\,\dot{E}_{it} \quad & \text{(Stepwise candidates)} \end{aligned} \tag{2}$$

EMPIRICAL RESULTS

Advanced Countries

The empirical results for the advanced countries are presented in Table2. As mentioned above, the LEGAL2 variable is designed to capture the influence of a variety of important legal factors. LEGAL2, a continuous scale variable, is obtained from Economic Freedom of the World index, where a higher score suggests a more competitive legal system. LEGAL2 has a positive and significant impact on economic growth at the 5% significance level.

In the next step, the deposit insurance protection variable (DEPOSITINS) is included in the economic growth model (Column 4). The coefficient on this variable is not statistically significant. The following three variables, BKCONCEN, NIM, and OHCOSTS, designed to measure the competitive banking environment are included sequentially in the model. BCONCEN and NIM both have the expected negative sign but none of the three variables are statistically significant at the 10% level (Columns 5-7). On the other hand, the three model results are similar and compared to Column (1) we see an increase in adjusted R-squared to approximately 0.55, a smaller AIC number, a smaller coefficient on our traditional measure of liquidity ($\dot{F}$), and a weaker significant level for D(C1BK). Furthermore, the slope coefficients for the control variables I/Y and $\dot{X}$ are increased in size. Even though none of three variables generated statistically significant results, they provide an increase in the model's adjusted R-squared. Two variables related to ownership structure, BKPRIVAT and FGENTRY, are sequentially included in the model, but neither generates statistically significant results (Columns 8 and 9).

The coefficients of the other regressor variables remain the same after including BKPRIVAT into the model; while after including FGENTRY, the adjusted R-squared falls a little and both the size and level of statistical significance of most of the other regressors also change. This may be due to a much shorter time span for the FGENTRY variable, which only covers the period from 1995 to 2003.

Table 2: Empirical Results- Advanced Countries

Dependent Variables Y		**FSD**	**Law**		**Regulation**	
Variables:	(1)	(2)	(3)	(4)	(5)	(6)
C	-0.024***	-0.019**	-0.047***	-0.034**	-0.019	-0.027
L	0.027	0.010	0.001	-0.011**	0.056	0.055
I/Y	0.179***	0.176***	0.198***	0.003***	0.200***	0.214**
X	0.167***	0.139***	0.136***	0.127***	0.189***	0.185***
F	0.065***	0.090***	0.077***	0.080***	0.054**	0.047*
D(CIBK)		-0.028***	-0.028***	-0.003	-0.012**	-0.013*
D(C2BK2)		0.008***	0.007**	0.027**	0.028**	0.028***
LEGAL2			0.003**			
DEPOSITINS				-0.001		
BKCONCEN					-0.012	
NIM						-0.087
OHCOST						
BKRRIVAT						
FGENTRY						
BKFREE						
D(TECHEXP)						
D(TECHIMP)						
Fixed effects-C	Y	Y	Y	Y	Y	Y
Fixed effects-P	N	N	N	N	N	N
# of AR(t)terms	1	2	2	0	1	1
Adj. R Squared	0.421	0.452	0.44	0.394	0.548	0.544
AIC	-4.824	-4.638	-4.95	-5.304	-5.334	-5.328
Observations	561	498	446	197	143	142
# of countries	19	18	18	15	15	15
Period	1967-2004	1968-2004	1968-2003	1966-2003	1991-2004	1991-2004
Redundant Fixed Effect Tests (F test)						

Dependent Variables Y	**Regulation**				**Technology**		**(Joint) Stepwise Regression**
Variables:	(7)	(8)	(9)	(10)	(11)	(12)	(13)
C	-0.027	-0.025*	-0.025	-0.106**	-0.020*	-0.025**	-0.055*
L	0.055	-0.004	0.040	-0.270	-0.003	0.009	0.046
I/Y	0.222*	0.178***	0.234**	0.643***	0.171***	0.194***	0.384***
X	0.188*	0.141***	0.157***	0.190***	0.165***	0.188***	0.171***
F	0.047*	0.079***	0.056*	-0.005	0.063***	0.052***	0.040
D(CIBK)	-0.012**	-0.028***	-0.011	-0.009	-0.025***	-0.026***	-0.015** $_{7}$
D(C2BK2)	0.027***	0.007**	0.016*	-0.019	0.005	0.005	0.020** $_{3}$
LEGAL2							
DEPOSITINS							
BKCONCEN							0.018 $_{4}$
NIM							0.361 $_{8}$
OHCOST	0.158						-0.477 $_{1}$
BKRRIVAT		0.001					-0.003 $_{2}$
FGENTRY			-0.001				
BKFREE				-0.004			
D(TECHEXP)					0.033**		0.152**$_{6}$
D(TECHIMP)						-0.024	-0.170***$_{5}$
Fixed effects-C	Y	Y	Y	Y	Y	Y	Y
Fixed effects-P	N	N	N	N	N	N	Y
# of AR(t)terms	1	1	0	4	1	4	0
Adj. R Squared	0.546	0.426	0.418	0.802	0.445	0.490	0.571
AIC	-5.322	-4.977	-5.045	-6.048	-5.046	-5.132	-5.225
Observations	142	443	115	53	411	350	144
# of countries	15	18	15	12	18	18	15
Period	1991-200	1967-2003	1995-200	1999-2004	1972-2004	1975-2004	1990-2003
Redundant Fixed Effect							P-Value:0.0105

Table 2 shows the regression coefficients of the equation: $\dot{Y} = C + Countries\ Dummies + \dot{L} + I/Y + \dot{X} + \dot{F} + D(C1BK) + D(C2BK2) + One\ External\ factor + error\ term$ *for the full sample of advanced countries. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.*

The BKFREE variable is designed to measure the competitiveness of the banking environment, with a higher score representing greater freedom. No statistically significant results are obtained after including BKFREE, although the adjusted R-squared is dramatically increased to 0.802. At the same time the variables, $\dot{F}$, D(C1BK), and D(C2BK2) are no longer significant. This may also be due to a shorter time span for the BKFREE variable, which covers the period from 1999 to 2004.

D(TECHEXP) and D(TECHIMP) are designed to measure a country's technology development, especially in the commercial services sector (e.g., computer, communication, etc.). D(TECHEXP) has a significant positive impact at the 1% significance level, while D(TECHIMP) shows a negative but statistically insignificant impact (Columns 11 and 12). The results suggest that a country with a higher percentage of commercial service exports experiences faster economic growth, since a country with sophisticated technology for export is likely to have greater productivity compared to a country which has to import technology.

Some of the external variables discussed in the previous section may have a collinear relationship with the complementary FSD measures, as well as potential collinearity among themselves. In columns (2) to (12) with individual external factors sequentially included, the complementary FSD measures (D(C1BK) and D(C2BK2) generally remain statistically significant. Thus the authors view these complementary FSD measures as relevant variables in an economic growth model. Finally, a stepwise least squares method is adopted to avoid variables selection problems where candidates for the economic growth model are the two complementary FSD measures and all the external factors. As before, the variables in economic growth model are $\dot{L}$, I/Y , $\dot{X}$, and $\dot{F}$ are control forced into the model.

Based on the F-test results for redundant fixed effects reported at the bottom of column (13) in Table 2, both cross-sectional and time period fixed effect adjustments are necessary. The DW statistic for the model with both cross-section and time period adjustments is close to 2.0. Therefore, the best model for the advanced countries includes both cross-sectional and time-period fixed effects. . The adjusted R-square has increased to 0.571 by simultaneously modeling the impact of complementary FSD measures and the external factors. Following stepwise procedures, the variables that remain in the final model are: 1) the two complementary FSD measures: D(C1BK) and D(C1BK2), 2) four regulatory factors: OHCOSTS, BKPRIVAT, BKCONCEN, and NIM, and 3) two technology factors: D(TECHIMP) and D(TECHEXP). The legal factor is not included in the final model. Note that the traditional liquidity ($\dot{F}$) becomes insignificant after simultaneously considering the above-mentioned factors. The regression coefficients on D(C1BK) and D(C1BK2) indicate both a negative and positive impact at the 5% significance level, respectively. Among the external factors, only the two technology factors, D(TECHEXP) and D(TECHIMP), are significant and report positive and negative impacts at the 5% and 1% significance levels, respectively.

Emerging Countries

The empirical results for the emerging countries are presented in Table 3. LEGAL2 shows a positive and statistically significant impact on economic growth at the 5% level with the regression coefficient comparable to those reported for the advanced countries. The coefficient estimates for $\dot{F}$, D (C1BK), and D (C2BK2) are similar regardless of the structure of the legal environment. Several interesting findings should be noted. First, based on the increased adjusted R-squared and AIC criterion, the model is improved by including DEPOSITINS (Column 4) although the variable itself is not statistically significant. Second, BKCONCEN (5) had a positive impact on economic growth and is statistically significant at the 10% significant level.

Table 3: Empirical Results-Emerging/Developing Countries

Dependent Variables Y		**FSD**	**Law**		**Regulation**	
Variables:	(1)	(2)	(3)	(4)	(5)	(6)
C	-0.013**	-0.008	-0.031***	-0.047***	-0.043***	0.001
L	0.619***	0.318***	0.482**	0.932*	0.316	0.428*
I/Y	0.127***	0.146***	0.164***	0.244***	0.238***	0.267***
X	0.130***	0.088***	0.090***	0.111***	0.093***	0.081***
F	0.046***	0.116***	0.099***	0.119***	0.094***	0.071***
D(CIBK)		-0.044***	-0.042***	-0.031***	-0.036***	-0.035***
D(C2BK2)		0.0032**	0.033***	0.035***	0.032***	0.031***
LEGAL2			0.003**			
DEPOSITINS				0.103		
BKCONCEN					0.025*	
NIM						-0.515***
OHCOST						
BKRRIVAT						
FGENTRY						
BKFREE						
D(TECHEXP)						
D(TECHIMP)						
Fixed effects-C	Y	Y	Y	Y	Y	Y
Fixed effects-P	N	N	N	N	N	N
# of AR(t)terms	1	1	3	1	1	1
Adj. R Squared	0.237	0.315	0.364	0.382	0.327	0.374
AIC	-3.353	-3.732	-3.953	-4.214	-4.106	-4.173
Observations	2053	1584	979	252	584	615
# of countries	66	61	51	20	58	57
Period	1967-2004	1967-2004	1973-2003	1967-2003	1991-2004	1990-2004
Redundant Fixed Effect Tests (F test)						

	Regulation				**Technology**		**(Joint) Stepwise Regression**
Variables:	(7)	(8)	(9)	(10)	(11)	(12)	(13)
C	-0.012	-0.021***	-0.056**	-0.010	-0.009	-0.002	-0.027
L	0.409*	-0.246*	0.605	0.353	0.228*	0.232*	1.196**
I/Y	0.199***	0.210***	0.434***	0.224***	0.143***	0.145***	0.289***
X	0.096***	0.097***	0.053***	0.074***	0.089***	0.089***	0.076***
F	0.089**	0.079***	0.102***	0.088***	0.109***	0.107***	0.050*
D(CIBK)	-0.031***	-0.046***	-0.051***	-0.039***	-0.040***	-0.039***	-0.030**$_3$
D(C2BK2)	0.030***	0.034***	0.033***	0.031***	0.031***	0.032***	0.035***$_2$
LEGAL2							0.005 $_4$
DEPOSITINS							0.010 $_{10}$
BKCONCEN							
NIM							-0.415**$_1$
OHCOST	-0.160**						-0.444* $_9$
BKRRIVAT		-0.000					0.003 $_7$
FGENTRY			-0.003				
BKFREE				-0.006**			-0.002 $_8$
D(TECHEXP)					0.008		-0.002 $_6$
D(TECHIMP)						-0.024*	-0.008 $_5$
Fixed effects-C	Y	Y	Y	Y	Y	Y	Y
Fixed effects-P	N	N	N	N	N	N	Y
# of AR(t)terms	0	1	0	0	1	1	0
Adj. R Squared	0.334	0.365	0.398	0.337	0.319	0.317	0.530
AIC	-4.140	-3.725	-3.995	-4.152	-3.821	-3.819	-4.422
Observations	628	1096	217	526	1315	1316	146
# of countries	58	51	35	57	61	61	22
Period	1990-2004	1971-2003	1995-2003	1995-2004	1971-2004	1971-2004	1995-2003
Redundant Fixed Effect Tests (F test)							P-Value: 0.0084

Table 3 shows the regression coefficients of the equation: $\dot{Y} = C + Countries\ Dummies + \dot{L} + I/Y + \dot{X} + \dot{F} + D(C1BK) + D(C2BK2) + One\ External\ factor + error\ term.$ *for the full sample of developing/emerging d countries. ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.*

The positive coefficient for BKCONCEN supports the "efficient-structure" theory that high bank concentration levels fostered by deregulation can promote increasingly competitive financial markets as only the most efficient banks remain competitive. NIM and OHCOSTS have the expected negative signs and are statistically significant at the 1% and 5% level, respectively (Columns 6 and 7). These three models are similar in terms of their adjusted R-square, AIC value, comparable coefficients on most of the control variables but somewhat smaller coefficients on $\dot{F}$.

The hypothesis that an enhanced competitive banking environment promotes economic growth is strongly supported by these results for the sample of emerging/developing countries. One other important result is that the coefficient on the $\dot{F}$ variable decreased in size from 0.11 to 0.094 by including the BKCONCEN variable. Third, neither BKPRIVAT nor FGENTRY are statistically significant. Fourth, the coefficient on BKFREE has an unexpected negative sign, which is significant at the 5% level. As shown in Columns (11) and (12), D(TECHEXP) has a positive but insignificant regression coefficient, while D(TECHIMP) has a statistically significant negative impact on economic growth. The statistical significance of these results are just opposite for the advanced countries. The level of technological exports from emerging/developing countries may be relatively small and these countries are forced to import technology, which at least in the short run reduces the rate of economic growth.

The stepwise regression procedure is also employed here. Based on the F-statistic for the redundant fixed effects test, both cross-section and time-period fixed effects are required. The DW statistic for the model with both cross-section and time-period adjustments is close to 2.0. The final results of the stepwise regression procedures presented in Column 13 include the following four sets of variables: 1) the two complementary FSD measures: D(C2BK2) and D(C1BK), 2) legal factor, LEGAL2, 3) five regulatory factors: NIM, BKPRIVAT, BKFREE, OHCOSTS and DEPOSITINS, and 4) two technology factors: TECHIMP and TECHEXP. The regression coefficient on NIM and OHCOST have the expected negative sign and are significant at the 5% and 1% levels, respectively. The basic liquidity measure of the banking system, $\dot{F}$, continues to report a positive and highly significant coefficient although the coefficient is smaller in size after considering the direct impact of the two complementary FSD measures and external factors. The coefficients on D(C1BK) and D(C2BK2) are negative and positive and are significant at the 5% and 1% levels, respectively. Note that LEGAL2, BKPRIVAT, DEPOSITINS, BKFREE, TECHEXP, and TECHIMP are not statistically significant but remain in the model following the stepwise procedure.

CONCLUSION

Various empirical studies provide evidence that certain external factors have significant impacts on a country's rate of economic growth. Demirguc-Kunt (2006) argues that it is crucial to consider all the relevant factors altogether in one model. This study demonstrates that the technological, legal, and regulatory environment can play a major role towards enhancing or retarding the smooth of functioning of the financial system and thus impact the rate of economic growth. By employing both an individual factor model and a joint impact model, this study also concludes that omitting certain relevant external factors (i.e. law, regulation, and technology) may bias the results. For example, for advanced countries, the level of a country's technology relate exports, D(TECHEXP), carries a positive and statistically significant and larger coefficient in the model after considering all the relevant external factors. In addition, the level of technology imports, D(TECHIMP), has no significant impact in the individual factor model but carries a negative and significant impact in the joint multi-factor model. For emerging countries, BKCONCEN and FGENTRY carry significant coefficients in the individual factor models, but both become insignificant after considering other relevant variables in the multi-factor model. For both advanced and emerging countries, LEGAL2 carries a significantly positive impact in the individual factor model but becomes insignificant in the joint factor model (Note that for the advanced countries, LEGAL2 is not even included in the final stepwise regression model).

This study also provides evidence that for both advanced and emerging countries, the superior model, based on the adjusted R-squared and AIC statistic, is the one that includes all the relevant factors together in one model. In addition, using the stepwise selection process, the complementary FSD measures

(D(C1BK) and D(C2BK2)) are both included in the final joint multi-factor model for both the advanced countries and emerging countries. The impact of the traditional intermediation factor ($\dot{F}$) also becomes insignificant in the advanced country model and weakly significant in the emerging country model. This result provides evidence that precise FSD measures are necessary in economic growth model as suggested by (Levine, 2004). Finally, missing variables for many of the external factors dramatically reduced the sample size.. Future studies can explore other types of external factors to strengthen the empirical results.

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HOW DOES FOREIGN DIRECT INVESTMENT AFFECT GROWTH IN DEVELOPING COUNTRIES? AN EMPIRICAL INVESTIGATION

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ABSTRACT

This paper analyzes the effects of foreign direct investment on the economic growth of developing countries. The study uses annual data on a group of 85 developing countries covering Asia, Africa, and Latin America and the Caribbean for the period 1980-2007. We explore the hypothesis that foreign direct investment can promote growth in developing countries. We test this hypothesis using panel data series for foreign direct investment, while accounting for regional differences in Asian, African, Latin American, and the Caribbean countries as well as the differences in income levels. While the findings of previous studies are generally mixed, our results indicate that foreign direct investment has positive and significant effect on economic growth.

JEL: F21, F43, O40

KEYWORDS: Foreign direct investment, developing countries, economic growth

INTRODUCTION

The role of foreign direct investment in the growth process of developing countries has been a topic of intense debate. Previous empirical studies on inward foreign direct investment (FDI) and economic growth generate mixed results. Foreign direct investment makes several contributions to the economies of host countries. Such contributions include: (a) foreign firms are making important contributions to the technological capacity of host countries; (b) the competition, standards and knowledge of foreign markets that foreign firms bring to the domestic market can have important spillover effects; and (c) many firms in developing countries have increased their access to cutting-edge technology by purchasing technologically sophisticated firms domiciled in high-income countries.

Foreign direct investment has dramatically increased in the past several decades to become a major force in the worldwide allocation of funds and technology (see Table 1). Prior to 1970, world trade generally grew at a greater pace than that of FDI , but in the decades since then the flow of FDI has grown at more than twice the rate of the growth of worldwide exports. According to the World Bank (2008), FDI inflows to developing countries have almost doubled as a percentage of GDP over the past 15 years. The data presented in Table 1 shows that the value of FDI flows to developing countries increased from $7.7 billions in 1980 to $499.7 billion in 2007, a 65-fold increase. Of the total FDI flows to developing countries, nearly 65% was accounted for by Asian developing countries. As a percent of total FDI flows, the share of developing countries increased from 13.9% in 1980 to 27.3% in 2007.

Given the importance of foreign direct investment to the economies of developing countries, it is important to understand its contribution to economic growth of developing countries. This paper analyzes the effects of foreign direct investment on the economic growth of developing countries. We analyze these effects using panel data series for foreign direct investment, while accounting for regional differences in Asian, African, Latin American, and the Caribbean countries as well as the differences in income levels. The main contribution of this paper is to analyze the effects of foreign direct investment on economic growth of developing countries covering a large number of developing countries as well as a

longer time period. The study focuses on the time period 1980-2007. In order to better understand the effect of FDI on growth as well as any change of its effect over time, we also estimated three separate models for shorter time periods, namely, 1980-1989, 1990-1999, and 2000-2007.

The paper is structured as follows: The next section presents a survey of literature, whereas Section 3 presents the specification of the econometric model and data sources. The empirical results are presented and discussed in Section 4 and finally, Section 5 summarizes the main results and concludes with some policy implications.

Table 1: Foreign Direct Investment Flows, 1980-2007

	FDI Flows (US$ Billions)						
Region	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2007**
World	55.3	58.0	201.6	342.6	1,411.4	958.7	1,833.3
Developed Economies	47.6	43.7	165.6	222.0	1,146.2	611.3	1,247.7
Europe	21.6	16.7	97.0	136.0	721.9	505.5	848.5
North America	22.7	21.9	56.0	68.0	380.8	131.8	341.6
Developing Economies	7.7	14.2	35.9	116.0	256.1	316.4	499.7
Africa	0.4	2.4	2.8	5.7	9.7	29.5	53.0
Latin America and the Caribbean	6.5	6.2	9.7	29.6	97.8	76.4	126.2
South and Central America	6.1	5.9	8.9	29.1	77.7	69.1	103.6
Caribbean	0.4	0.3	0.8	0.5	20.1	7.3	22.6
Asia and Oceania	0.8	5.5	23.3	80.7	148.6	210.6	320.5
Asia	0.7	5.4	22.6	80.0	148.3	210.0	319.3
Oceania	0.1	0.1	0.7	0.7	0.3	0.5	1.2
South-East Europe and the CIS	0.0	0.0	0.1	4.6	9.0	26.0	76.5
	Share of FDI Flows (%)						
Region	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2007**
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Developed Economies	86.1	75.5	82.2	64.8	81.2	63.8	68.1
Europe	39.0	28.8	48.1	39.7	51.2	52.7	46.3
North America	41.1	37.7	27.8	19.9	27.0	13.7	18.6
Developing Economies	13.9	24.5	17.8	33.8	18.1	33.0	27.3
Africa	0.7	4.2	1.4	1.7	0.7	3.1	2.9
Latin America and the Caribbean	11.7	10.8	4.8	8.6	6.9	8.0	6.9
South and Central America	11.0	10.3	4.4	8.5	5.5	7.2	5.7
Caribbean	0.7	0.5	0.4	0.2	1.4	0.8	1.2
Asia and Oceania	1.4	9.5	11.6	23.6	10.5	22.0	17.5
Asia	1.2	9.4	11.2	23.4	10.5	21.9	17.4
Oceania	0.2	0.2	0.3	0.2	0.0	0.1	0.1
South-East Europe and the CIS	0.0	0.0	0.0	1.4	0.6	2.7	4.2

This table shows the flow of foreign direct investment during the period 1980-2007. The top part of the table shows the value of investment flows while the bottom part shows the share of investment flows. The figures were taken from the United Nations Conference on Trade and Development, World Investment Report 2008.

LITERATURE REVIEW

The relationship between FDI and economic growth has drawn great attention for years, but the empirical results are mixed. For a recent comprehensive survey of the theoretical and empirical literature on foreign direct investment and growth see Lim (2001). The relationship between FDI and economic growth has drawn great attention for years, but the empirical results are mixed. The impact of FDI on growth is manifold. Through capital accumulation in the recipient economy, FDI is expected to be growth enhancing through encouraging the incorporation of new inputs and technologies in the production process (Li and Liu, 2005). Bengoa and Sanchez-Robles (2003) show that FDI is positively correlated with economic growth, but host countries require human capital, economic stability, and liberalized markets in order to benefit from long term FDI inflows. Using data on 80 countries for the period 1979–98, Durham (2004) fails to identify a positive relationship between FDI and economic growth, but instead suggests that the effects of FDI are contingent on the ‘‘absorptive capability’’ of host countries.

The literature on foreign direct investment and growth has gone a long way to identify different channels through which FDI affects growth. For instance, Borensztein, Gregorio and Lee (1998) suggests that FDI enhances growth via increasing domestic capital formation, technology and improved productivity only if the host country has a threshold level of human capital. Balasubramanyam, Salisu and Sapsford (1996) assert that endogenous growth theory provides a new conceptual framework to analyze the effect of FDI on growth through its effect on host countries exports. Bhagawati (1978) points out that volume and efficiency of FDI are more pronounced in export oriented host countries.

Ram and Zhang (2002), in a cross-sectional regression framework, find some evidence that FDI is boosting host economies' income growth rates, based on data for the 1990s while noting that the results are not robust to all their model specifications. Dutt (1997), on the other hand, fails to find a clear linkage between foreign investment and per capita growth rates. Nonetheless, using a panel of data for the 1970-1999 period for 84 countries, Li and Liu (2005) establish a clear linkage between FDI and growth rates. They confirm this outcome for different econometric techniques, including a simultaneous equation system. In contrast, Carkovic and Levine (2005) also use a panel setting and control for simultaneity bias, but do not find robust results for positive growth effects of FDI inflows in their sample of 72 countries for the period 1960-1995. They note that this outcome (and the inconclusive evidence in the literature in general) might be due to the specific empirical approaches and the different time periods used.

A recent study by Wang (2009), using the sector-level FDI inflows to 12 Asian economies over the period 1987 to 1997, find strong evidence for a positive and significant effect on FDI inflows and economic growth in the host economies. The study also finds that FDI inflows in non-manufacturing sectors do not play a significant role in enhancing economic growth. Furthermore, without the decomposition of total FDI inflows, the effect of manufacturing FDI on host country's economic growth is understated by at least 48%.

Borensztein, et al. (1998) report that the association between FDI from OECD countries and economic growth is positive for a sample of 69 developing countries but only for those countries with relatively high levels of human capital. They argue that FDI from more technologically advanced countries creates technological spillovers that countries with high levels of human capital are able to capture. Hermes and Lensink (2003) report that a sufficiently advanced financial sector is necessary for FDI to promote economic growth. De Mello (1999) examines complementarities between domestic investment and FDI and finds that whether or not FDI matters for economic growth depends on the substitutability between FDI and domestic investment.

Others find little effect of FDI on growth. Hein (1992) reports little association between FDI and economic growth once he controlled for policies denoting an overall strategy of inward development. Tsai (1994) develops a simultaneous equation model with economic growth and FDI per capita as dependent variables but does not find any strong, general effects from FDI on growth in a sample of developing countries taken from the 1970s and 1980s.

METHODOLOGY AND DATA

Specification of Model

This section discusses the model specifications to examine the relationships between foreign direct investment and per capita GDP growth. The models specified are estimated using panel least squares estimation method. The model is derived, in conventional manner, from a production function in which FDI is introduced as an input in addition to labor and domestic capital. FDI is the prime source of human capital and new technology to developing countries and this variable is included in the production

function in order to capture the externalities, learning by watching and spill-over effects associated with FDI .
In the usual notation the production function can be written as follows:

$$Y = f(L, K, F) \tag{1}$$

where Y is gross domestic product (GDP) in real terms, L is labor input, K is domestic capital stock, and F is stock of foreign direct investment.

Assuming (1) to be linear in logs, taking logs and differencing, we obtain the following expression describing the determinants of the growth rate of real GDP:

$$y = \alpha + \beta l + \delta k + \phi f \tag{2}$$

where lower case letters denote the rate of growth of individual variables. Following the precedent set in numerous previous studies, we approximate the rate of growth of the capital stock by the share of investment in GDP. This is necessary due to the formidable problems associated with attempts to measure the capital stock, especially in the context of developing countries. In addition, we also replace the rate of change in labor input by the growth rate of population. Following Ram and Zhang (2002) and others, we also include an education variable representing human capital since it is often believed to have a favorable effect on growth. These changes yield the following growth equation:

$$GGDP_{it} = \beta_0 + \beta_1 GPOP_{it} + \beta_2\left(\frac{INV}{GDP}\right)_{it} + \beta_3\left(\frac{FDI}{GDP}\right)_{it} + \beta_4 EDU_{it} + \beta_5 INF_{it} + e_{it} \tag{3}$$

where $GGDP_{it}$ is the growth rate of real GDP of country i in year t, $GPOP_{it}$ is the growth rate of population of country i in year t, INV is the investment of country i in year t, FDI is the foreign direct investment of country i in year t, EDU_{it} is the mean years of educations for the population 15 years and older of country i in year t, and INF_{it} is the inflation rate of country i in year t. The growth rate of population is a proxy for the growth rate of labor force, and the investment/GDP ratio represents the growth rate of capital stock. The FDI /GDP variable represents the growth rate of the stock of foreign direct investment. Regional dummies, a dummy variable representing ethnic wars, and a variable representing the economic freedom are also introduced. We are interested in testing whether the marginal impact of foreign direct investment on growth, β_3, is positive and statistically significant. The expected signs of the coefficients β_1, β_2, β_3, and β_4 are positive, and that of β_5 is negative. In order to see whether there is complementarity between FDI and the host country's human capital, equation (3) can be augmented by adding an education- FDI interaction term, which will have a positive coefficient if there is such a complementarity. We experimented by adding such an interaction term and the results are reported in Tables 2, 3 and 4.

Variable Description and Data Sources

In order to test the implications of our models, we collected a panel of aggregate data on foreign direct investment on a large number of developing countries. The entire data set includes 85 countries for which foreign direct investment and all other relevant variables are reported over the 1980–2007 period. The sample of countries consists of 26 low-income countries, 29 low-middle-income countries, 23 high-middle-income countries, and 7 high-income countries. The list of countries used in the empirical analysis is given in Appendix Table 1.

The economic growth rate is measured in this study as the growth of real GDP in constant (2000) U.S. dollars. The data on real GDP are from the World Bank, *World Development Indicators* database. The growth rate of population is used as a proxy for the growth rate of the labor force. The data on population are from the World Bank, *World Development Indicators* database. The investment/GDP ratio is used as a proxy for the growth rate of the capital stock. Since the investment/GDP ratio is not reported for the majority of the developing countries, gross fixed capital formation as a share of GDP is used to represent investment/GDP ratio.

The data on investment/GDP ratio are also from the World Bank, *World Development Indicators* database. The data on foreign direct investment are from the United Nations Conference on Trade and Development (UNCTAD), *World Investment Report 2008*. Inflation rate is defined as the annual percentage change in Consumer Price Index (CPI). The data on inflation rate are from the International Monetary Fund, *World Economic Outlook* database, October 2008. The variable EDU is measured as mean years of education for the population aged 15 years and older and is taken from the compilation by Robert Barro and Jong-Wha Lee. The data on ethnic war variable are from the World Bank. The data on economic freedom are from the Freedom House, *The Freedom in the World 2008* database.

EMPIRICAL RESULTS

The results of our empirical analysis are presented in Tables 2, 3 and 4. First, we estimated model (3) for four different time periods: 1980-1989, 1990-1999, 2000-2007 as well as for the entire period of 1980-2007. The results of this analysis are presented in Table 2. Then we estimated the model for different regions, namely, Asia, Africa, and Latin America and the Caribbean. The results of this analysis are presented in Table 3. Finally we estimated the model for different income levels, namely, low income, low middle income, upper middle income and all income levels. The results of this analysis are presented in Table 4. Models were estimated using several dummy variables to incorporate regional differences as well as the differences in income levels. Refer first to Table 2 which presents the estimated results of growth equation (3), estimated for four different time periods.

The investment ratio has the expected positive sign and is highly statistically significant in all cases. This result is similar to the finding of recent studies by Ram and Zhang (2002) and Li and Liu (2005). Population growth variable, which also represents the growth of labor force, has the expected positive sign in all four cases but statistically significant only for the period 2000-2007. These finding is also consistent with the findings of previous studies.

The growth rate of foreign direct investment has a positive impact on economic growth of developing countries. The coefficient of this variable is positive in all four models and statistically significant during the time periods 2000-2007 and 1980-2007. While the previous studies on the impact of foreign direct investment on growth have generated mixed results, our results suggest that the foreign direct investment can have a positive impact on economic growth in developing countries. For example, Ram and Zhang (2002), Li and Liu (2005), Bengoa and Sanchez-Robles (2003), Olofsdotter (1998) and Borensztein et al. (1998) show that FDI is positively correlated with economic growth. Durham (2004) fails to identify a positive relationship between FDI and economic growth.

The estimated coefficient of the education variable, which a proxy for human capital, has the expected positive sign in three of the four models estimated. However, this coefficient is statistically significant only in one case. The findings of previous studies are also consistent with the findings of this study. The evidence in favor of complementarity between FDI and the host country's human capital is lacking. In most estimates of equation (3), the interaction term has the "wrong" (negative) sign. However, the interaction term is significant in three of the four cases considered. Ram and Zhang (2002) also could not find evidence of complementarity in their study conducted using the data for the 1990s. However,

Borensztein, De Gregorio, and Lee (1998), find evidence of complementarity in the 1980s which is consistent with our findings.

Table 2: Effects of Foreign Direct Investment on Growth in Developing Countries Dependent Variable: Real GDP Growth

Variable	1980-1989	1990-1999	2000-2007	1980-2007
Constant	0.214	1.514	-0.061	0.791
	(0.16)	(1.21)	(1.07)	(1.02)
Capital Growth	0.119***	0.104***	0.127***	0.108***
	(6.05)	(6.07)	(9.19)	(9.41)
Labor Growth	0.067	0.141	0.920*	0.077
	(0.47)	(0.88)	(6.07)	(1.64)
FDI/GDP	0.029	0.023	0.017**	0.021**
	(1.22)	(1.11)	(1.85)	(2.27)
Education	-0.129	0.052	0.189**	0.093
	(-1.07)	(0.49)	(2.39)	(1.39)
(FDI/GDP) x Education	0.009**	-0.007	-0.004**	-0.003**
	(2.01)	(-1.24)	(-2.35)	(-2.20)
Inflation	-0.001***	-0.001***	-0.002**	-0.001*
	(-2.67)	(-2.78)	(-1.87)	(-4.84)
Economic Freedom	-0.576**	-0.102	-0.051	-0.098
	(-2.55)	(-0.53)	(-1.39)	(-1.09)
Ethnic Wars dummy	-0.324	-1.381***	-1.731***	-0.940***
	(-0.93)	(-4.75)	(-4.20)	(-4.47)
Asia dummy	3.292***	1.010	1.953***	1.743***
	(5.39)	(1.64)	(5.12)	(4.54)
Latin America dummy	0.315	-0.981	-0.042	-0.852**
	(0.50)	(-1.60)	(-1.12)	(-2.25)
Sub-Saharan Africa	1.897***	-1.395**	0.392	-0.062
dummy	(3.21)	(-2.34)	(1.14)	(-0.17)
Low Income countries	-0.313	-0.025	-1.576***	-0.142
dummy	(-0.42)	(-0.64)	(-2.89)	(-0.34)
Low Middle Income	0.545	0.292	-1.658***	0.397
countries dummy	(0.84)	(0.52)	(-3.51)	(1.11)
Upper Middle Income	0.920	0.204	-1.551***	0.246
countries dummy	(1.43)	(0.36)	(-3.12)	(1.24)
Number of countries	85	85	85	85
Number of observations	850	850	680	2,380
Adjusted R2	0.352	0.441	0.674	0.356

*This table shows the empirical results of the models estimated for different time period, as given in equation (3). The results indicate that foreign direct investment has a positive effect on economic growth. Figures in parentheses are t-values. *** and ** indicate the statistical significance at the 1% and 5% level, respectively.*

Inflation rate variable has the expected negative sign and it is statistically significant for all four cases. These findings are also consistent with the findings of previous studies. The variable representing the economic freedom has a negative sign in all four cases. This variable is defined as follows: 1 if free; 2 if partly free; and 3 in not free. Therefore, the negative sign can be interpreted as countries which are relatively free tend to have a higher economic growth. The ethnic war dummy variable has a negative sign in all cases and highly statistically significant, implying that ethnic wars have an adverse effect of economic growth.

Of the three regional dummy variables used in the model, Asia dummy variable consistently has a positive sign and statistically significant in three of the four cases. This result is not surprising given the fact that nearly two thirds of foreign direct investment flows to developing countries went to an Asian country. Dummy variables for the other two regions have mixed results. The dummy variables representing the different income levels indicate that the estimated coefficients are negative for low-income countries and mostly positive for low middle income and upper income countries. These findings are not surprising given that they are ones lacking less distorted market systems, more stable macroeconomic environments, and better human resources. Let us now discuss the estimated results that are presented in Table 3.

The conventional variables behave very much the same way as the model predicts, and several estimated coefficients are statistically significant. The adjusted R^2 values range from a low of 0.140 to a high of 0.571. These values, though relatively low, are acceptable for a cross-sectional study and are comparable to those obtained in other studies.

The coefficients of the first two variables in model (3) are expected to be positive and our results are consistent. Although the capital growth variable is statistically significant in all four regions, labor growth variable is statistically significant only for Latin American region. The growth rate of foreign direct investment has a positive impact on economic growth of developing countries. The coefficient of this variable is positive in all four models. However, this variable is positive for African region indicating that foreign direct investment has a significantly positive effect on economic growth in African countries. The evidence in favor of complementarity between FDI and the host country's human capital is lacking in this case as well.

Table 3: Regional Differences and the Effects of FDI on Growth in Developing Countries Dependent Variable: Real GDP Growth

Variable	Asia	Africa	Latin America	All Countries
Constant	-2.619	-1.597	-0.576	-0.561**
	(-1.50)	(-0.98)	(-0.45)	(-0.81)
Capital Growth	0.231***	0.066***	0.130***	0.135***
	(6.34)	(3.87)	(6.90)	(9.87)
Labor Growth	0.096	0.118	0.319*	0.013
	(1.24)	(0.69)	(1.80)	(1.14)
FDI Growth	0.021	0.033*	0.005	0.006
	(1.34)	(1.74)	(1.32)	(1.57)
Education (EDU)	0.040	0.172	0.128	0.220***
	(1.38)	(1.12)	(0.95)	(3.21)
(FDI Growth) x EDU	-0.001	-0.004	-0.002	-0.002
	(-0.22)	(-0.91)	(-0.87)	(-1.27)
Inflation	-0.001***	-0.001***	-0.002***	-0.001***
	(-2.72)	(-2.63)	(-4.44)	(-5.42)
Economic Freedom	-0.423	-0.880***	-0.549**	-0.112
	(-1.56)	(-3.94)	(-2.02)	(-0.10)
Ethnic Wars dummy	-0.836*	-1.747***	-0.075	-0.579***
	(-1.84)	(-4.36)	(-0.20)	(-2.74)
Low Income countries dummy	1.953	3.827***	-1.066	1.094***
	(1.60)	(3.80)	(-1.13)	(2.62)
Low Middle Income countries dummy	2.029*	4.829***	0.731	0.511
	(1.83)	(4.15)	(1.30)	(1.43)
Upper Middle Income countries dummy	1.685	4.493***	0.736	0.063
	(1.39)	(3.87)	(1.48)	(1.02)
Number of countries	14	32	29	85
Number of observations	392	896	812	2,380
Adjusted R^2	0.571	0.236	0.140	0.226

*This table shows the empirical results of the models estimated for different regions, as given in equation (3). The results indicate that foreign direct investment has a positive effect on economic growth. Figures in parentheses are t-values. *** and ** indicate the statistical significance at the 1% and 5% level, respectively.*

Finally, let us now discuss the estimated results that are presented in Table 4. The conventional variables behave very much the same way as the model predicts, and several estimated coefficients are statistically significant. The adjusted R^2 values range from a low of 0.212 to a high of 0.418. These values, though relatively low, are acceptable for a cross-sectional study and are comparable to those obtained in other studies.

The coefficients of the first two variables in model (3) are expected to be positive and our results are consistent. Although the capital growth variable is statistically significant in all four regions, labor growth variable is statistically significant only for upper-middle income countries. The growth rate of foreign direct investment has a statistically positive impact on economic growth of low-income developing

countries. The coefficient of this variable is negative for low-middle-income countries. The evidence in favor of complementarity between FDI and the host country's human capital is found only in the case of low-middle-income countries. Based on the results presented in Tables 2-4, it can be concluded that foreign direct investment has a positive effect on economic growth in developing countries.

Table 4. Income Differences and the Effects of FDI on Growth in Developing Countries Dependent Variable: Real GDP Growth

Variable	Low-Income Countries	Low-Middle-Income	Upper-Middle-Income	All Countries
Constant	-3.083**	1.394	0.267	1.252**
	(-2.30)	(1.21)	(0.30)	(1.78)
Capital Growth	0.147***	0.070*	0.115*	0.108*
	(6.49)	(6.21)	(9.36)	(9.80)
Labor Growth	0.248	0.154	0.918*	0.060
	(1.12)	(0.99)	(6.39)	(1.61)
FDI Growth	0.062**	0.005	0.015	0.001
	(2.36)	(1.63)	(1.24)	(1.27)
Education (EDU)	0.018	0.024	0.038	0.044
	(1.10)	(0.26)	(0.48)	(0.74)
(FDI Growth) x EDU	-0.010	0.001	0.008*	-0.001
	(-1.30)	(0.12)	(3.72)	(-0.10)
Inflation	-0.001**	-0.001*	-0.002**	-0.001*
	(-2.54)	(-2.83)	(-1.89)	(-4.83)
Economic Freedom	-0.063	-0.114	-0.103	-0.106
	(-1.27)	(-0.66)	(-0.82)	(-0.87)
Ethnic Wars dummy	-1.070	-1.155*	-1.458*	-0.967*
	(-1.59)	(-4.38)	(-3.58)	(-4.83)
Asia dummy	4.415***	-0.027	-1.427*	-0.201
	(5.18)	(-0.65)	(-2.77)	(-0.49)
Latin America dummy	0.189	0.475	-1.535*	0.363
	(0.18)	(0.89)	(-3.54)	(1.03)
Sub-Saharan Africa	2.496***	0.393	-1.483*	0.162
dummy	(3.02)	(0.71)	(-3.20)	(1.46)
Number of countries	26	85	85	85
Number of observations	728	850	680	2350
Adjusted R^2	0.418	0.634	0.672	0.355

*This table shows the empirical results of the models estimated for different income levels, as given in equation (3). The results indicate that foreign direct investment has a positive effect on economic growth. Figures in parentheses are t-values. *** and ** indicate the statistical significance at the 1% and 5% level, respectively.*

CONCLUDING REMARKS

This paper analyzes the effects of foreign direct investment on the economic growth of developing countries. We analyze these effects using panel data series for foreign direct investment, while accounting for regional differences in Asian, African, Latin American, and the Caribbean countries as well as the differences in income levels. The main contribution of this paper is to analyze the effects of foreign direct investment on economic growth of developing countries covering a large number of developing countries as well as a longer time period. The major point emerging from this work is that foreign direct investment has a positive impact on economic growth of developing countries. First, when the model was estimated for different time periods, foreign aid variable has a positive sign in all four cases, indicating that foreign direct investment appears to have a positive effect on economic growth in developing countries.

Second, when the model was estimated for different regions, foreign direct investment variable still has a positive sign in all four cases, indicating that foreign direct investment appears to have a favorable effect on economic growth in developing countries. Finally, when the model was estimated for different income levels, foreign direct investment variable has a positive sign in three out of four cases. However, this variable is negative for low-middle-income countries indicating that foreign aid has a negative effect on

economic growth in these countries. The findings of this study are, for the most part, consistent with findings of previous studies on the effects of foreign direct investment on economic growth.

The policy implications of this paper are straightforward. First, foreign direct investment may promote economic growth significantly in the process of development. Second, increase of FDI in quantity enhances economic growth only under some conditions. A less distorted market system, more stable macroeconomic environment, better human resources, export-oriented strategy, diversified economic and export structure will improve the relationship between growth and FDI in developing countries.

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APPENDIX

Table 1: List of Developing Countries Included in the Study

Income Group	Countries
Low-Income Countries	Bangladesh, Burundi, Central African Republic, Congo, Dem. Rep., Gambia, Ghana, Guinea-Bissau, Haiti, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Pakistan, Papua New Guinea, Senegal, Sierra Leone, Solomon Islands, Tanzania, Togo, Uganda, Vietnam, Zambia, and Zimbabwe.
Low-Middle-Income Countries	Algeria, Bolivia, Cameroon, China, Colombia, Congo, Rep. of, Dominican Republic, Ecuador, Egypt, El Salvador, Guatemala, Guyana, Honduras, India, Indonesia, Iran, Jordan, Kenya, Lesotho, Nicaragua, Paraguay, Peru, Philippines, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Thailand, and Tunisia.
Upper-Middle-Income Countries	Argentina, Belize, Botswana, Brazil, Chile, Costa Rica, Dominica, Fiji, Jamaica, Libya, Malaysia, Mauritius, Mexico, Panama, Seychelles, South Africa, South Korea, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Turkey, Uruguay, and Venezuela.
High-Income Countries	Antigua and Barbuda, Bahrain, Barbados, Kuwait, Singapore, Trinidad and Tobago, and United Arab Emirates.

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IMPACT OF SMALL BUSINESS ADMINISTRATION LENDING ON STATE-LEVEL ECONOMIC PERFORMANCE: A PANEL DATA ANALYSIS

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ABSTRACT

Based on the few studies in their 2009 literature review, Craig, Jackson, and Thomson find that the economic impact of SBA loans on regional economic performance is positive, albeit small This study analyzes the relationships between economic performance and SBA lending using a panel of state-level data for the 1986-2008 period. It focuses primarily on the SBA 504-guaranteed lending program because this program's objective is to provide long-term financing to small firms. Through its Certified Development Companies working with local banks, the SBA is able to provide long-term, fixed rate loans so that businesses can acquire physical assets such as land and buildings and help generate jobs. Thus, the main purpose of this paper is to analyze and measure the impact of SBA 504 loans on various indicators of small business activity such as employment rate and per capita income, while also controlling for other determinants of state economic growth. A preliminary test showed that SBA lending is not endogenous at the state-level. As a result, moderated regression analysis was applied to the state-level panel data set whereby the dependent variable is regressed sequentially on certain control variables, independent variables, and then an interaction term. A version of Craig's model was estimated using three different dependent variables – income growth, small firm growth, and employee growth. The control variables of location quotient and NBER showed that local industrial composition and national business cycles are important determinants of state economic performance. The estimated coefficients for SBA lending were found to be small, insignificant, and had the unexpected negative signs with respect to its relationship with income. On the other hand, SBA loans had a positive and significant impact on the growth of small businesses and by consequence, the number of workers employed in small firms. The bank deposit variable had a positive and significant relation only with employee growth, albeit a very small effect. Finally, this study found that SBA lending was not biased in favor of lower income areas.

JEL: R11; O16

KEYWORDS: Small business lending, endogeneity, panel data

INTRODUCTION

One of the major ways by which the U.S. federal government has tackled the current credit crunch especially for small businesses is to raise the loan guaranteed amounts (up to $255 million this year) and to lower fees on Small Business Administration (SBA) loans. Still, some big banks have not been keen on participating in the program due to perceived burdens in the paper work and application process (Flandez, *Wall Street Journal*, 2009). The objectives of this study are to examine the lending patterns of the SBA in the 50 states over the period 1986-2008 and to evaluate the relationship between the supply of SBA small business credit and local economic performance in these states. In particular, it emphasizes the role of the Small Business Administration's Certified Development Company 504 Program loans in promoting long-term local economic growth. The economic impact of the SBA 504 program and its related operating units, the Certified Development Companies (CDCs), is especially significant in light of recent adverse developments in the financial markets. In November

2007, the U.S. Congress called into question the effectiveness of the SBA as a lending agency to small business firms. Congress wanted to know the effect of SBA-guaranteed loans on the revenues, jobs, and investments of the companies receiving these loans (CNNMoney.com, November 2, 2007). In response, a 2008 economic impact study was commissioned by the National Association of Development Companies, the trade association of CDCs, and conducted by the Applied Development Economics, Inc. (ADE). After a survey of CDCs and evaluation of over 800 SBA 504 program loans issued during the 2003-2005 period, the study concluded that:

> *"…the 504 loan program very clearly provides a cost effective means of generating new business activity of the national economy. In addition, the corresponding increase in tax revenues for the federal government is many times greater than the funding required to administer the program." (ADE, p. 2)*

This study analyzes the relationships between state economic growth and the SBA 504 loan program using a cross-section of state data for 1986-2008. Through its Certified Development Companies working with local banks, the SBA 504 program is designed to provide long-term financing for businesses to acquire fixed assets and to stimulate local economic growth via job creation, business expansion, and tax revenue generation. Thus, the main purpose of this paper is to analyze and measure the impact of SBA 504 loans on various indicators of small business activity such as per capita income and employment, while also controlling for other determinants of state economic growth.

The rest of the paper is organized as follows. The next section provides a background on SBA lending patterns and a review of the past studies. This is followed by a description of the model, statistical method, and data used in the study. The results section discusses the findings of applying panel regression on the data. The final section provides the general conclusions of the study.

HISTORICAL TRENDS AND LITERATURE REVIEW

Table 1 below shows the total U.S. levels of SBA 504 loans, with values starting in September 1986 and ending in September 2008. At the national level, the flow of SBA 504 lending increased from approximately $528 million in 1987 to over $609 million in 2007, representing an average annual growth rate of about 15%.

The national pattern shows a general rise in the real value of SBA 504 loans from 1987 until 1996, followed by a decline in 1997 to 2000. Starting in 2001, lending dramatically increased up to 2007. The top ten states with the largest amounts of loans received during the 1986-08 period are:

California	$13 trillion or 24% of total SBA 504 loans
Florida	$2.9 trillion or 5.4%
Texas	$2.8 trillion or 5.1%
New York	$2.2 trillion or 4%
Illinois	$2 trillion or 3.73%
Minnesota	$2 trillion or 3.7%
Ohio	$1.7 trillion or 3.1%
Colorado	$1.6 trillion or 2.96%
Utah	$1.6 trillion or 2.92%
Georgia	$1.5 trillion or 2.85%

Table 1: Value of SBA 504 Loans (in 2005 $)

Year	SBA Loan
1986	305,331,204
1987	527,723,735
1988	434,153,878
1989	520,279,961
1990	632,320,605
1991	667,302,487
1992	863,978,937
1993	1,193,213,208
1994	1,674,630,173
1995	2,015,752,784
1996	2,769,568,152
1997	1,873,509,414
1998	2,193,683,623
1999	2,315,125,287
2000	2,041,602,056
2001	2,672,142,962
2002	2,903,906,723
2003	3,471,942,698
2004	4,346,307,706
2005	5,600,611,120
2006	5,613,108,805
2007	6,093,056,312
2008	3,531,215,398

The smallest loan amounts went to the following states:

Delaware	$65.8 million or 0.12% of total SBA 504 loans
West Virginia	$89 million or 0.16%
Alabama	$102 million or 0.19%
Vermont	$109 million or 0.20%
Wyoming	$156 million or 0.29%
Montana	$178 million or 0.33%
South Dakota	$197.5 million or 0.36%
Hawaii	$205 million or 0.38%
Rhode Island	$206 million or 0.38%
Maine	$231 million or 0.43%
Nebraska	$256.6 million or 0.47$

These state-level differences are obviously due to various regional factors such as population, industrial diversity, and economic growth. In an early study, Doctors and Wokutch (1979) analyzed the geographical patterns of SBA lending activity in nine metropolitan areas. They compared and contrasted SBA total loans per capita, per number of small businesses, and per number of small business employees for 1968-76. Doctors and Wokutch found that much of SBA lending was focused or concentrated in areas with the largest number of small firms. They felt that this was counterintuitive and contrary to the SBA's purpose of providing credit to regions with the most need. Table 2 presents state-level data for SBA 504 lending per 1,000 small firms (defined as firms with less than 500 employees) and for SBA lending per 10,000 employees in small firms for the 1988-2006 period.

Table 2: Real SBA Lending Per Firm and Per Employee, 1988-06

State	Average Loan Value per 1,000 Small Firms (in 2005 $)	Average Loan Value per 10,000 Employees (in 2005 $)
Alabama	489,693.0	481,001.4
Alaska	250,228.3	305,532.9
Arizona	584,864.8	579,165.3
Arkansas	255,685.5	274,170.6
California	827,682.4	825,387.4
Colorado	611,840.8	728,377.8
Connecticut	206,903.0	205,436.0
Delaware	157,813.5	173,380.2
Florida	312,934.8	394,736.9
Georgia	402,093.2	424,358.5
Hawaii	352,654.3	334,178.6
Idaho	864,411.3	1,047,312.0
Illinois	340,871.7	329,759.8
Indiana	382,038.4	345,019.3
Iowa	396,542.8	392,443.0
Kansas	292,316.0	295,335.5
Kentucky	186,216.9	177,175.1
Louisiana	194,050.6	182,617.3
Maine	284,454.4	328,586.7
Maryland	275,282.0	269,360.2
Massachusetts	358,259.3	343,732.8
Michigan	252,663.6	240,988.2
Minnesota	780,910.9	740,275.3
Mississippi	251,880.1	262,255.6
Missouri	458,141.6	463,037.9
Montana	281,939.4	377,684.5
Nebraska	277,952.5	289,521.8
Nevada	1,246,120.0	1,238,825.0
New Hampshire	1,132,809.0	1,196,075.0
New Jersey	98,955.77	110,463.9
New Mexico	452,471.3	482,081.5
New York	220,677.9	248,522.9
North Carolina	300,384.9	307,581.1
North Dakota	772,904.9	808,965.7
Ohio	349,967.6	312,734.5
Oklahoma	271,209.2	291,120.1
Oregon	351,801.8	388,404.1
Pennsylvania	145,987.3	136,392.0
Rhode Island	367,428.2	386,410.6
South Carolina	213,724.9	220,876.4
South Dakota	403,259.5	440,220.9
Tennessee	224,265.4	212,849.6
Texas	296,092.4	292,415.9
Utah	1,578,049.0	1,638,631.0
Vermont	234,553.1	272,747.9
Virginia	382,393.7	384,224.5
Washington	412,970.8	458,103.3
West Virginia	128,603.5	140,035.6
Wisconsin	512,670.5	459,045.1
Wyoming	454,943.9	596,461.9
Total US	417,651.4	436,680.4

In general, "small" states in terms of absolute numbers of small businesses as well as employees in these small businesses received higher amounts of SBA 504 lending (for example, Utah, Nevada, New Hampshire, Idaho, and North Dakota) compared to the U.S. average. However, "large" states such as California, Minnesota, Wisconsin, and Missouri also ranked high in terms of these ratios. Thus, this current study attempts to determine the factors that influence the geographical distribution of SBA credit.

In their recent 2009 study and in 2007, Craig, Jackson, and Thomson surveyed the few studies (mostly theirs) which empirically test the impact of SBA guaranteed lending on economic performance; they generally find a positive, albeit small, impact of SBA financing and that the SBA lending-growth relationship is more significant in low-income markets. In another survey of the literature, Watkins (2007) underscored the fact that SBA lending accounts for less than 10 per cent of all lending in a given local economy. He also recommended that future studies consider the long-run nature of the SBA-growth relationship and employ other performance measures such as job creation/growth, small business failure rates, and local tax revenues as dependent variables.

Craig *et al.* (2006) analyzed data for all SBA 7(a) and 504 loans from 1991-2002 for MSA and non-MSA counties in the U.S. In their basic OLS fixed effects model, the employment rate is regressed on per capita income, Herfindahl index (to measure banking market concentration), a dummy variable for MSA county, total bank deposits per capita (a measure of financial development), total SBA loans per capita, and an interaction term equal to the product of bank deposits and SBA loans. The interaction term is Craig *et al.*'s focus in that a negative estimated slope parameter for this variable would mean that the impact of SBA lending is less at higher levels of bank deposits, or alternatively, SBA credit has more impact in low-income counties. In their analysis, Craig, *et al.* disregarded the important issue of endogeneity or simultaneity of bank deposits. They argued that they are primarily interested in the effect of the interaction term of deposits and SBA lending on employment. Craig *et al.* found a negative and statistically significant coefficient for the interaction term thus indicating that "…at higher levels of financial market development, per capita SBA lending has a lower impact on employment than it does at lower levels of financial market development." (p. 23) The authors concluded that SBA lending serves a "social welfare function" by providing needed small business credit and reducing shortcomings in the credit market especially in low income areas. Craig *et al.* admit that they do not know if SBA financing leads to growth because of "completing" the banking market or whether SBA loans are a substitute for other sources of small business credit. In addition, they cannot test whether SBA loans actually increase the amount of small business lending in the market.

In their earlier 2004 study, Craig *et al.* used per capita income as the measure of economic performance. Their main explanatory variable of interest is SBA loans scaled by total deposits. Control variables include market structure variables (Herfindahl index and rural-urban dummy), local (employment rate) and national economic conditions (a dummy variable for national economy in recession), and types of SBA lending (share of 7(a) loans, share of loans going to manufacturing firms). The model was tested for levels and rates of change. In the levels regression, the SBA loan to deposit variable is positive but insignificant. However, using growth rates, Craig *et al.* found that SBA lending significantly and positively affect income growth but only after two lags.

A 2003 study by PM Keypoint LLC for the SBA Office of Advocacy examined the impact of SBA loan programs on local business activity during periods of economic contraction or tight money. In contrast to Craig *et al.*, this analysis used state-level annual data for 1991-2000 and measured the effects of bank capital, SBA lending, loan delinquency rates, and local and national economic conditions (primarily interest rates) on small business activity. The dependent variable is represented by three factors: number of business firms, employment, and payroll. The study found that SBA guaranteed loans were positively related to business activity especially during periods of tight money and slow economic growth, thereby acting as a stabilizer.

Although there have been very few empirical studies of the impact of SBA lending, the importance of small business credit supply has long been recognized (see, for example, Ou and Williams, 2009). Government regularly collects micro data from businesses and financial institutions via surveys such as the Survey of Small Business Finances, Call Reports, and in reports required under the Community

Reinvestment Act (CRA) to monitor and assess the lending markets for small firms in the U.S. In a study similar to Craig *et al*'s 2006 paper, Hicks (2004) used CRA data to measure the effect of CRA-reported loans on employment for the 55 counties of West Virginia for the period 1996-98. In his growth model, county employment (classified according to four different employee ranges) was regressed on CRA-reported loans of less than $100,000, human capital (education), public capital (with construction expenditures as proxy), county distress ranking, a trend variable, and a spatial autocorrelation adjustment. Hicks found that the loans to small businesses had a positive and statistically significant effect but only for firms with five to nine employees.

The current paper extends the above previous studies with some differences. First, it applies an economic model and method developed by Driscoll (2004) who used state panel data to test whether bank loan supply influences state-level per capita income. Second, it addresses the econometric issue of endogeneity or simultaneity (which the earlier studies did not take into account), also following Driscoll. Third, it re-examines Craig, Jackson, and Thomson's finding that the link between SBA guaranteed lending and economic growth is stronger in low-income areas. Finally, it tests the relationship between SBA credit and other economic growth indicators, specifically the growth of small business firms and employment change in small businesses.

DATA AND METHODOLOGY

To analyze the relationship between SBA 504 lending activity and state-level economic growth (measured in terms of income, small firm growth, and employees in small firms), this study uses data from four government sources. Annual loan data for 1986-2008 were kindly provided by the Small Business Administration. State personal income data were gathered from the Bureau of Economic Analysis while total deposits and interest expense were from the Federal Deposit Insurance Corporation. Employment data used to calculate the location quotients were taken from the Bureau of Labor Statistics.

The model estimated here follows from earlier studies by CJT. It differs primarily in the following ways: (1) the model is applied only to SBA 504 loans received in the 50 states in 1986-2008; (2) it corrects for the endogeneity problem since SBA lending may be responding to local economic growth or performance. The method used here is derived from Driscoll (2004) who employs a two-step procedure: (1) in the first stage, he estimates a state panel regression of bank loans (commercial and industrial) on output and money demand shocks, and; (2) in the second stage, he regresses output on the supply of bank loans. According to Driscoll, using money demand shocks as instrumental variables in this two-stage least squares (2SLS) technique answers the question: "Do changes in bank deposits affect the quantity of loans?" If these instruments are found to be statistically significant, then this evidence indicates the presence of a lending channel whereby firms (especially small firms) are dependent on their local bank lending sources. Driscoll estimates shocks to money demand using the standard money supply-money demand equilibrium condition. Money supply is measured by real per capita bank deposits in the state. Real money supply is then regressed on real per capita state income and on the interest rate (defined as the ratio of interest expense to total deposits); the estimated residuals represent the money demand shocks.

The current study applies Driscoll's procedure but differs in the following ways. First, although Driscoll's intention was to determine the impact of loans on small business firms, he uses total commercial and industrial bank loans; on the other hand, this study employs SBA loans targeted specifically for "small businesses." Second, this study uses a larger and more recent pooled cross-section (50 states) and time-series (1986-2008) data set. Third, it estimates an expanded economic growth model following Craig *et al* (2004). Finally, instead of using 2SLS method, the Hausman two-step test of endogeneity is performed.

The generalized model of state per capita personal income takes the following form:

$$PI = b_1 + b_2SBA + b_3DEP + b_4(SBA*DEP) + b_5NBER + b_6LQ + b_7SBA7a + e \quad (1)$$

where PI is state-level per capita income, SBA is per capita SBA 504 loans, DEP is bank deposits per capita, SBA*DEP is an interaction term, NBER is a dummy variable equal to one if the year is a recession year, LQ is the location quotient for manufacturing, SBA7a is the share of total SBA lending that is a SBA 7(a) loan (the most basic and commonly used SBA loan type; for more information, see www.sba.gov), and *e* is the error term.

The interaction term (SBA*DEP) is the variable of interest here. The effect of SBA lending on economic growth depends on the value of DEP. Craig and others find that the coefficient b_4 is negative indicating that SBA credit is biased in favor of lower income areas (where bank deposits are a proxy for the financial depth of an area). NBER, LQ, and SBA7a are considered control variables reflecting local and national economic conditions. The dummy variable, NBER, reflects the impact of the national business cycle. The manufacturing location quotient, LQ, is a ratio of the share of manufacturing employment in state employment to the share of overall manufacturing in U.S. employment; thus, a ratio greater than one indicates that a state's manufacturing sector accounts for a larger share of state employment as compared to that of the nation. LQ and the share of 7(a) loans in the state's total SBA loans represent the local environment.

To test and correct for simultaneity with respect to the SBA variable, the Hausman two-step procedure is followed (see Pindyck and Rubinfeld, 1998, p. 353-355). In the first step, SBA is regressed on the money demand shocks and the other independent variables in the economic growth model (1). In the second step, the estimated residuals from the first step regression are then added as another explanatory variable in equation (1). If the estimated coefficient of the residual variable is significant, then the model has considered the simultaneity issue and is therefore the correct and robust model.

Preliminary testing of the variables for unit roots indicated that SBA loans, income, and bank deposits are stationary in first-differences; thus, the estimated regressions included two lags, based on the Schwartz criterion test (Pindyck and Rubinfeld, p. 238-239).

EMPIRICAL RESULTS

The results of applying the Driscoll method on the state-level panel data indicated the absence of any simultaneity bias. Thus, the economic growth model is estimated using panel least squares and using the following stepwise procedure: (1) the control variables, NBER, LQ, and SBA7a, are entered first (these control variables represent both national and local economic conditions); (2) the main independent variables of SBA 504 credit and bank deposits are entered to join the control variables; (3) in the full model, the interaction term, SBA*DEP, is entered to join the independent and control variables.

The results of applying this procedure appear in Table 3. Model 1 shows that the NBER recession dummy and the location quotient are negatively and significantly related to state-level income growth. State incomes tend to fall during recession years and are more vulnerable when the state economy is relatively more dependent on a manufacturing base. Lagged income growth (two periods back) is also significant but the share of SBA7(a) loans is not a factor. In Model 2, inclusion of the main independent variables, SBA and DEP, as well as lagged effects reveal that SBA and DEP have the unexpected negative effect on output/income. This confirms earlier findings by Driscoll and Craig *et al* of very small and often negative effects of loans. The important finding in Model 3 is that the estimated parameter for the interaction term is infinitesimal and statistically insignificant, albeit with a negative sign.

Table 3: Dependent Variable is Growth Rate of Per Capita Income

Predictor	Model 1 Control Variables	Model 2 Control and Independent Variables	Model 3 Full Model
Constant	0.02	0.02	0.025
	(5.68)***	(6.29)***	(6.38)***
Lagged Income (-1)	0.05	0.03	0.03
	(1.71)	(0.93)	(0.90)
Lagged Income (-2)	0.14	0.14	0.14
	(4.81)***	(4.67)***	(4.63)***
NBER	-0.02	-0.02	-0.02
	(-9.83)***	(-9.65)***	(-9.67)***
LQ	-0.004	-0.004	-0.004
	(-1.95)**	(-2.29)**	(-2.28)**
SBA7a	-0.0002	-0.0003	-0.0007
	(-0.05)	(-0.08)	(-0.18)
Growth of SBA		-0.003	-0.003
		(-2.22)**	(-2.23)**
Lagged SBA (-1)		-0.009	-0.009
		(-5.72)***	(-5.71)***
Lagged SBA (-2)		-0.0003	-0.0003
		(-0.22)	(-0.21)
Growth of Deposits		0.00006	0.00006
		(1.29)	(1.31)
Lagged Deposits(-1)		-0.0001	-0.0001
		(-1.96)**	(-1.96)**
Lagged Deposits(-2)		0.00006	0.00006
		(1.07)	(1.08)
SBA*DEP			-0.0000
			(-1.07)
Adjusted R^2	0.10	0.13	0.14
F-statistic	22.35***	14.02***	12.95***
No. of observations	1,000	971	971

*This table shows regression estimates for three versions of Equation (1) above, with per capita income as dependent variable. Model version 1 includes only the control variables. Model version 2 includes both control variables and independent variables. Model version 3 is the full equation (1) with the interaction term. T-statistics are in parentheses. ** and *** indicate significance at the 5 and 1 percent level respectively.*

Equation (1) is also estimated for two other dependent variables, growth of small firms and growth of employees in small businesses, to evaluate the effectiveness of SBA guaranteed lending activity. Given available data, the time period considered here is 1988-2006. Table 4 shows the results with small firm growth as the dependent variable. The control variables, LQ and NBER, as well as the lagged small firm growth rate are consistently significant and have the expected signs.

After controlling for these variables, the findings reveal that SBA lending activity directly and significantly influences the growth of small firms in the states. On the other hand, the coefficients for financial assets and the interaction term are very negligible and insignificant. Similar results are found in Table 5 including the important finding that deposit growth has a significant and positive relationship with the growth of employees in small businesses. Finally, in both regressions, the impact of the SBA*DEP interaction term is insignificant, as evidenced by the minute absolute value of the estimated coefficient as well as the absence of any change in the adjusted R-squared as a result of adding the interaction term into the model.

Table 4: Dependent Variable is Growth in Small Firms

Predictor	Model 1 Control Variables	Model 2 Control and Independent Variables	Model 3 Full Model
Constant	0.01	0.01	0.01
	(3.85)***	(3.17)***	(3.20)***
Lagged Firms (-1)	0.69	0.67	0.67
	(21.62)***	(20.61)***	(20.60)***
Lagged Firms (-2)	-0.04	-0.01	-0.01
	(-1.27)	(-0.38)	(-0.39)
NBER	-0.01	-0.01	-0.01
	(-10.74)***	(-10.55)***	(-10.55)***
LQ	-0.004	-0.004	-0.004
	(-4.20)***	(-3.76)***	(-3.75)***
SBA7a	0.001	0.002	0.002
	(0.58)	(0.77)	(0.73)
Growth of SBA		0.005	0.005
		(5.61)***	(5.62)***
Lagged SBA (-1)		0.002	0.002
		(2.19)**	(2.19)**
Lagged SBA (-2)		0.001	0.001
		(1.39)	(1.40)
Growth of Deposits		0.00001	0.00001
		(0.57)	(0.58)
Lagged Deposits(-1)		0.00001	0.00001
		(0.17)	(0.17)
Lagged Deposits(-2)		-0.00004	-0.00004
		(-1.47)	(-1.46)
SBA*DEP			-0.00000
			(-0.46)
Adjusted R^2	0.58	0.60	0.60
F-statistic	223.73***	108.35***	99.24***
No. of observations	800	779	779

*This table shows regression estimates for three versions of Equation (1) above, with small firm growth as dependent variable. Model version 1 includes only the control variables. Model version 2 includes both control variables and independent variables. Model version 3 is the full equation (1) with the interaction term. T-statistics are in parentheses. ** and *** indicate significance at the 5 and 1 percent level respectively.*

CONCLUSION

In their studies, Craig and others concluded that SBA lending matters especially for low-income areas. This paper added to the literature by applying Craig's approach to a panel data of U.S. states for the 1986-2008 period. A preliminary test was to determine if a two-way causality exists between SBA credit and income growth. The Hausman simultaneity test showed that SBA lending is not endogenous at the state-level. As a result, moderated regression analysis was applied to the state-level panel data set whereby the dependent variable is regressed sequentially on certain control variables, independent variables, and then an interaction term. A version of Craig's model was estimated using three different dependent variables – income growth, small firm growth, and employee growth.

Overall, the control variables of location quotient and NBER showed that local industrial composition and national business cycles are important determinants of state economic performance. The estimated coefficients for SBA lending were found to be small, insignificant, and having the unexpected negative signs with respect to its relationship with income. This confirms earlier studies and may be a statistical consequence of the fact that SBA lending accounts for a very small part (less than 10%) of total lending in the economy. On the other hand, SBA loans have a positive and significant impact on the growth of small businesses and by consequence, the number of workers employed in small firms. The bank deposit variable had a positive and significant relation only with employee growth, albeit a very small effect. Finally, the coefficient for the interaction term between SBA and DEP is statistically insignificant and

minute in absolute value in all regressions, although it has the expected negative sign. This insignificant result is contrary to Craig's findings. Thus, this study finds that SBA lending is not biased in favor of lower income areas thereby questioning the effectiveness of the SBA in providing credit lines to firms in most need.

Table 5: Dependent Variable is Growth in Employees in Small Firms

Predictor	Model 1 Control Variables	Model 2 Control and Independent Variables	Model 3 Full Model
Constant	0.02	0.02	0.02
	(5.16)***	(4.71)***	(4.76)***
Lagged Employees (-1)	0.37	0.37	0.37
	(11.68)***	(11.52)***	(11.48)***
Lagged Employees (-2)	0.01	0.01	0.01
	(0.32)	(0.25)	(0.24)
NBER	-0.03	-0.03	-0.03
	(-13.54)***	(-12.86)***	(-12.86)***
LQ	-0.006	-0.006	-0.006
	(-3.50)***	(-3.03)***	(-3.03)***
SBA7a	-0.003	-0.003	-0.003
	(-0.72)	(-0.76)	(0.82)
Growth of SBA		-0.0004	-0.0004
		(-0.26)	(-0.24)
Lagged SBA (-1)		0.0006	0.0006
		(0.35)	(0.37)
Lagged SBA (-2)		0.003	0.003
		(2.36)**	(2.37)**
Growth of Deposits		0.00008	0.00008
		(1.90)*	(1.91)*
Lagged Deposits(-1)		-0.0001	-0.0001
		(-1.78)*	(-1.76)*
Lagged Deposits(-2)		0.00004	0.00004
		(0.76)	(0.77)
SBA*DEP			-0.000000
			(-0.68)
Adjusted R^2	0.30	0.29	0.29
F-statistic	68.20***	30.50***	27.98***
No. of observations	800	779	779

*This table shows regression estimates for three versions of Equation (1) above, with small firm employees as dependent variable. Model version 1 includes only the control variables. Model version 2 includes both control variables and independent variables. Model version 3 is the full equation (1) with the interaction term. T-statistics are in parentheses. ** and *** indicate significance at the 5 and 1 percent level respectively.*

This study has limitations. First, the use of the state as the unit of analysis may be inappropriate given the importance of local market conditions (for example, local interbank competition, distance to bank, etc.) in the lending process. Second, as Craig and his colleagues point out, "we do not know whether SBA loan guarantees are contributing to economic performance by helping to complete the market or are simply proxying for small business lending in the market." (2006, p. 26) Further extensions of this study will examine more disaggregated data such as county-level or firm-level data. It will also incorporate local banking conditions such as banking market concentration, distance between banks and their small business borrowers as well as other sources of small business credit.

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EVIDENCE ON MARKET MICROSTRUCTURE IN INDONESIAN MARKETS

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ABSTRACT

Divergence of opinion causes market prices to differ from intrinsic values. Greater divergence of opinion results in larger bid/ask spreads. This study utilizes Miller's theory (Miller, 1977) which states that differences between bid and ask prices (price spread) is caused by divergence of opinion between buyers and sellers. This study tests a price spread condition that reflects the existence of agency conflict referred to as stock price premium (SPP) and stock price discount (SPD). The conditions relate to agency cost control mechanisms that result from foreign and domestic institutional ownership. This research employs Structural Equation Modeling (SEM) with multi-group structural equation modeling (MSEM). The results show SPD has lower agency conflict than SPP, and a negative effect of foreign and domestic institutional ownership to agency cost.

JEL: G3; G30; G32; G38

KEYWORDS: Stock price premium, stock price discount, agency cost, ownership

INTRODUCTION

This study utilizes Miller's, 1977 theory, which states that disputes between buying, and selling investors are caused by divergence of opinion. This study focuses on the divergence of opinion and the magnitude of agency costs. Buying and selling investors agree on a closing price thereby implicitly revealing the dominant party.

How does the trade activity reflect a company's agency cost? Stockholders as owners of a company have strong interest in the price of stocks they own. Other parties interested in the stock price are potential stockholders. The selling and buying process of stocks is the process of identifying the agreement point that produces a closing price. What is the process of reaching a closing price? Sellers (stockholders) will sell with the highest offer price possible and buyer (potential stockholder) will try to buy at the lowest possible bid price. Bargaining is utilized to arrive at the closing price.

Of interest is how sellers set an offer price and buyers set a bid price. This study proposes the concept that setting the offer price and bid prices reflects a conflict of interest, or agency problem, between the parties in the company (management, stockholders and creditors). Agency conflicts, according to Jensen and Meckling (1976), occur because the company influences the wealth of all stakeholders. If agency conflicts are low, the closing transaction price will be closer to the offer price. On the contrary, if the agency conflicts are high, the closing price achieved will be closer to the ask price.

Agency theory studies ignore the existence of agency conflicts related to the establishment of a closing price through negotiations between offer price and bid prices. The literature focuses on the agency conflict and its control mechanism. This study tests a new condition. The condition reflects the existence of agency costs. These agency costs manifest themselves in the form of stock price premiums and discounts. A stock price premium occurs when the closing price is close to the offer price. A stock price discount occurs when the closing price is close to the bid price. This study assumes that the expectation of high company value is a result of low agency cost. If stockholders and potential stockholders perceive that agency conflicts are low, they value the company higher than other similar companies.

The findings are related to institutional ownership as a conflict control mechanism. This study proposes that stock price premiums and discounts are important issues in identifying agency costs. Both conditions reflect the level of agency conflict in the company. This study argues that a stock price premium indicates low agency problems and a discount indicates high conflict levels.

A closing price close to the offer price shows that sellers obtain a price close to their offer. Buyers are willing to buy with a price close to offer price because they expect higher future prices. Old stockholders tend to hold-out for the offer price. If stockholders are convinced that the value of the company can be increased they holdout for the offer price. This causes the closing price to be close to offer price.

This study examines daily closing prices, the difference between offer price and closing price, and between bid price and closing price. Therefore, this study employs the perspective of market microstructure to explain agency cost. Studies in microstructure give understanding to the behavior and operation of capital market based on intra-day movement (O'Hara, 1999). This study employs a microstructure approach combined with corporate finance research model.

To date, studies on agency theory do not investigate bargaining between sellers and potential stockholders in arriving at a closing price. Different closing prices reflect different agency conflicts among companies. The effect of the different agency conflicts among companies will cause a number of companies to trade for a stock price premium and others at a stock price discount. Identification of stock price premium and stock price discount conditions in this study provide a better explanation for the existence of various agency cost reduction mechanisms. This study focuses on foreign institutional ownership and domestic institutional ownership as a reduction mechanism for agency conflict.

The existence of mixed results in previous studies regarding the relationships between foreign and domestic institutional ownership to agency cost leaves open a fruitful area for new research. This study introduces a price spread condition to better explain the role of control mechanisms on agency conflict through foreign and domestic institutional ownership.

The remaining of this research organized as follows. After describe the related literature and background of the study, this research explains the arguments of price spread, agency conflict, and ownership structures. Next, the research methods are introduced. The following sections present the results and discussion. The paper closes with some concluding comments.

LITERATURE REVIEW

Jensen and Meckling, 1976 introduced social and private costs resulting from incomplete alignment of agent and owner interests. Agency theory brought the roles of managerial decision rights, various external and internal monitoring and bonding mechanisms to the forefront of theoretical discussions and empirical research. Research demonstrates the empirical role of agency costs in financial decisions such as capital structure, maturity structure, dividend policy and executive compensation. However, the actual measurement of the principal variable of interest, agency costs, in both absolute and relative terms, has lagged.

To measure absolute agency costs, a zero agency cost base case is observed as a reference point. In the Jensen and Meckling (1976) agency theory, the zero agency cost base case is a firm owned solely by a single owner manager. When management owns less than 100 percent of the firm's equity, shareholders incur agency costs resulting from management's shirking and perquisite consumption. Because of limitations imposed by personal wealth constraints, exchange regulations on the minimum numbers of shareholders, and other considerations, no publicly traded firm is a single owner managed firm. Thus, Jensen and Meckling's zero agency cost base case cannot be measured from publicly traded firms for

which information is readily available. The absence of information about sole owner manager firms explains the inference of agency costs in empirical finance literature.

Agency costs emerge when the interests manager and owners interest differ. Agency costs come in many forms including preference for on the job perquisites, shirking and making self interested and entrenched decisions that reduce shareholder wealth. The magnitude of these costs is limited by how well the owners and delegated third parties, such as banks, monitor the actions of the outside managers.

The core of agency theory is the existence of a conflict of interest between agents and principals resulting in a reduced firm value. Equity agency costs include monitoring and bonding cost along with residual loss (Jensen and Meckling, 1976). Monitoring cost include expenses incurred in an effort to control agent behavior through budget tightening, compensation policy, and operational regulations. Bonding costs guarantee that agents will not undertake certain actions that will inflict financial loss towards principals. In the event that loss does occur, principles are compensated by the bonding agency.

Residual loss includes the monetary value of principals' wealth reduction because of conflicting interests between agents and principals. These conflicts stimulate agents to conduct selfish actions and inflict financial loss to principals. These actions can be in the form of inefficient choices such as investing in unprofitable investments or incurring wasteful expenses. There also exists a debt agency cost including paying abnormally large dividends, monitoring costs and bonding costs. The reduction of agency cost can achieved through mechanisms such as manager stock ownership, combining financing sources from debt and equity, and dividend payout (Crutchley and Hansen, 1989).

Miller (1977) proposed a theory explaining the agreement on a price between selling investors and buying investors. Miller's theory loosens the assumption of homogenous expectation in the balance model. Miller (1977) argues that divergence of opinion among investors causes security price differences. The dispute mechanism causes the forming price to be further or closer to its intrinsic value. Greater divergence of opinion causes a greater gap between the price and its' intrinsic value.

This study relates agency cost to the price spread condition between stock price premiums and stock price discounts. Agency conflict experienced by a company manifests in the stock price premium and stock price discount. The agency conflict reflected in the stock price premium and discount are an agency conflict called perceived conflict. Therefore, this study employs perceived agency conflict (stock price premium and stock price discount) to explain actual agency conflicts.

Amihud and Mendelson (1986) and Brennan and Subrahmanyam (1996) state that bid-ask spread measurement can be used to determine the price of an asset. Their studies on microstructure are also useful in determining the value of an asset. This study uses bid-ask spreads as an indicator of agency conflict and introduces a price span condition, consisting of price premiums and discounts.

Baker and Wurgler (2004a, 2004b) employ the term stock price premium to explain why some companies pay dividends and others do not. This study adopts the term stock price premium and discount to test the influence of ownership structure and agency cost on firm performance. As noted earlier, Stock price premium is a condition that occurs when the closing price of a company tends to be closer to offer price. A stock price discount is a condition that occurs when that closing price of company's stocks tends to be closer to bid price. Stock price premium and stock price discount show expectations of stockholders for ownership structure and agency cost which affects company's performance.

A closing price close to the bid price shows that sellers are forced to sell their stocks at a price lower than their offer. Perhaps this occurs because the market does not respond to the offer price and the stockholders need to sell their stocks immediately. Potential stockholders (buyers), obtain the stocks with

a price close to their bid price. Stockholders realize that the firms agency cost is high. Thus, market participants estimate that the stock price will move lower. Stockholders give a discount to potential stockholders to entice a purchase. This condition causes the tendency of company's closing price agreed by both parties to be close to the bid price. Buyers are convinced that high agency costs cause the company's value to be low, but the value of the company can increase through better ownership structure mechanisms and financial policies.

The conditions of stock price premium and discounts result from a firm's agency conflict. A closing price that is systematically close to the offer or bid price shows that buyers and sellers do take into account agency costs in daily transactions. The level of agency conflict causes differences between the closing price and the offer and bid price. As noted earlier. a stock price premium reflects a low level of agency conflict. On the other hand, a stock price discount reflects a low level of agency conflict.

Ownership structure becomes important in agency theory because most agency conflicts result from ownership and control separation. Agency conflict does not occur in companies with 100% management ownership (Jensen and Meckling, 1976). External owners produce a discrepancy of interest. Conflicts occur between principals and agents as discussed in positivist agency theory. Conflicts between stockholders, management, employees and other parties are within principal-agent research (Eisenhardt, 1989).

Institutional ownership reduces agency conflicts (Shleifer and Vishny, 1986; Jarrel and Poulsen, 1987; Brickley et al., 1988; Graves and Waddock, 1990; Han et al., 1999; and Varma, 2001). These studies argue that institutions that invest in the company will monitor a company better than individual investors. Institutions have professionals who understand the companies and monitor management. An institutional ownership sale position drives the stock price down. Therefore, institutional owners avoid selling stocks and instead monitor the company to improve performance. Effective monitoring enhances firm value. Pozen (1994) stated that the most efficient monitoring method employed by institutional owners is informal discussions with managers.

HYPOTHESES

The hypotheses development in this study consists of foreign institutional ownership, domestic institutional ownership, agency cost and company performance in the form of stock price premium and stock price discount.

As noted earlier, agency theory argues that institutional ownership reduces agency conflicts because institutions will monitor the company reducing management discretion to act sub-optimally (Crutchley et al., 1999; and Chen and Steiner, 1999). This is valid when the institutional owner partially monitors management. However, when the institutional owner is the majority owner, monitoring focuses on institutional interests and ignores public stockholder interests. Foreign institutional ownership is utilized as a control method to decrease agency costs. Higher foreign institutional ownership results in lower agency costs and lower foreign institutional ownership results in higher agency costs. Therefore, hypothesis H_1 is as follows:

H_1: Foreign institutional ownership has negative impact on agency cost.

This study assumes that the agency conflicts in stock price premiums are low relative to stock price discounts. This assumption implies an agency conflict reduction mechanism through foreign institutional ownership. A stock price premium will have less negative influence compared to a stock price discount. Companies with low agency conflicts will closely observe agency-conflict control costs. They tend to

decrease conflict reduction costs through ownership structure agency reduction mechanisms. Therefore, hypothesis H_2 is as follows:

H_2: Foreign institutional ownership will affect agency cost negatively; lower when firm is trading at a stock price premium than a stock price discount.

Domestic institutional ownership also acts as a monitoring party, similar to foreign institutional ownership. Core and Larcker (2002) found a negative relationship between stock performance and domestic institutional ownership. Companies with high institutional ownership (more than 5%) have an ability to monitor management. Large institutional ownership results in more efficient asset utilization. Therefore, institutional ownership prohibits management inefficiency.

Ismiyanti and Hanafi (2004) found that average institutional ownership between 1997-2001 reaches 66% of total stocks outstanding. This result implies that 34% of stocks are held by public individual investors, management and directors. This is different in the United States, where the institutional ownership reaches 52.36% of total stocks outstanding in 1999 (Chen and Steiner, 1999). The domestic institutional ownership is used as control method to decrease agency costs. Therefore, hypothesis H_3 is as follows:

H_3: Domestic institutional ownership has negative influence towards agency cost.

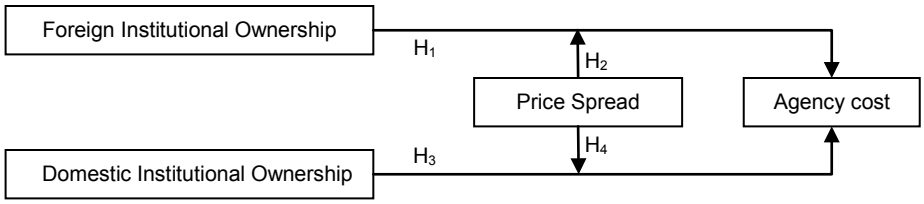
This study assumes that the agency conflict indicated by a stock price premium is lower than for a stock price discount. This implies a reduction mechanism of agency conflict through foreign institutional ownership. Stock price premiums will have a less negative influence relative to stock price discounts. Companies with low agency conflict will closely observe the cost to control agency conflict. Thus, they tend to decrease conflict through ownership structure in an effort to drive costs down. Therefore, hypothesis H_4 is as follows:

H_4: Domestic institutional ownership will affect agency cost negatively; lower when firm is trading at a stock price premium than a stock price discount.

Research Framework

The following research framework depicts the relationship between foreign institutional ownership, domestic institutional ownership and agency cost:

Figure 1: Research Framework



Note: Price spread consists of stock price premium and stock price discount. H1 and H3 test the institutional ownership structure (domestic and foreign) to agency cost. H2 and H4 test the effect of price spread to the relationship between institutional ownership (domestic and foreign) and agency cost.

METHODOLOGY

Samples employed in this study are non-financial companies listed on the Jakarta Stock Exchange from 1995 to 2004. Financial data obtained from annual financial reports include the balance sheet, income

statement, cash flow report and financial report notes. The data sources were the Jakarta Stock Exchange Library, Indonesian Capital Market Directory (ICMD) and Indonesian Securities Market Database (ISMD) published by Faculty of Economics and Business, Gadjah Mada University.

Data on the following variables were collected: The agency cost proxy is asset utilization and operational cost (Ang et al., 2000); and free cash flow (Hackel et al., 1996). Asset turnover equals the ratio of total sales to total assets and is used to measure agency costs. Selling and General Administrative (SGA) is included in operational expense proxy. Operational expense measures the agency expenses based on SGA, which is the ratio of operational expense to total sales. Free cash flow (FCF) used in this study employs free cash flow, as in Hackel et al. (1996), which modifies the traditional free cash flow. This method avoids sample elimination while still maintaining the appropriateness of free cash flow proxy.

$$FCF = TFCF + DOCO + DCEX \quad (1)$$

$$TFCF = (OCR - OCO) - CEX \quad (2)$$

where TFCF is traditional free cash flow; OCR is operating cash inflow; OCO is operating cash outflow; while CEX is capital expenditure.

$$DOCO = (\text{OCO growth} - \text{sales growth}) * (0.2 * OCO) \quad (3)$$

where DOCO is discretionary operating cash outlay. Hackel et al. (1996) assumes 20% of OCO is discretionary of OCO and sales growth.

$$DCEX = (\text{CEX growth} - \text{Cost of Good Sold Growth}) * CEX \quad (4)$$

$$\text{OCO growth} = (OCO_t - OCO_{t-1})/OCO_{t-1} \quad (5)$$

$$\text{sales growth} = (sales_t - sales_{t-1})/sales_{t-1} \quad (6)$$

$$\text{CEX growth} = (CEX_t - CEX_{t-1})/CEX_{t-1} \quad (7)$$

$$\text{Cost of Goods Sold (COGS) Growth} = (COGS_t - COGS_{t-1})/COGS_{t-1} \quad (8)$$

where DCEX is discretionary capital expenditure; and COGS is cost of goods sold.

Stock price premium occurs when the closing price tends be close to the offer price. Stock price discount occurs when closing price tends to be close to the bid price and is measured as follows:

$$\text{Stock Price Premium} = |\text{Closing Price} - \text{Offer Price}| \quad (9)$$

$$\text{Stock Price Discount} = |\text{Closing Price} - \text{Bid Price}| \quad (10)$$

Foreign institutional ownership is the sum and percentage of stocks owned by foreign institutions. Domestic institutional ownership is the percentage of ownership by registered as non-public stockholders.

This research employs Structural Equation Modeling (SEM) in hypotheses testing because SEM has the ability to combine measurement and structural models. This research applies two stage approaches for multi-group structural equation modeling (MSEM). MSEM does not require a nested model to estimate different hypotheses groups. A series of statistical goodness-of-fit indicators is employed to test a complex model. SEM is conducted in two structural models, constrained and unconstrained parameters models. In constrained parameter models, regression estimate weights are controlled in both sample groups resulting in a similar estimated relationship. The moderating variable is significant if models with unconstrained parameters are better than models with constrained parameters.

RESULTS AND DISCUSSION

This research uses a full structural equation model to analyze research hypotheses that do not contain stock price premium and stock price discount moderating variables, H_1 and H_3. Hypotheses, which used stock price premium and stock price discount moderating variables (H_2 and H_4), are tested by employing multi-group structural equation model using constrained parameters and unconstrained parameters models. Table 1 shows the full structural equation model without stock price premium and stock price discount as moderating variables.

Table 1: Result of Full Structural Equation Model

Structural Relationship	Unstandardized Regression Weight	Standard Error	Critical Ratio
Agency Cost ← Foreign Inst. Ownr.	-0.243	0.086	-3.481*
Agency Cost ← Domestic Inst. Ownr.	-0.378	0.092	-0.643
Asset Utilization ← Agency Cost	1.000		
Operating Expense ← Agency Cost	0.863	0.078	5.429*
Free Cash Flow ← Agency Cost	0.068	0.089	0.983

*This table shows the structural relationship of institutional ownership structure (domestic and foreign) to agency cost. The full model also shows the regression weight of asset utilization, operating expense and free cash flow as proxy of agency cost. *) significant 10%*

Table 2 shows the test result by multi-group structural equation model with constrained parameters. The numbers of observations used total 1,559 comprising 713 observations with stock price premium and 846 observations with stock price discount. The results show that the regression coefficient value of ownership structure influence (foreign institutional ownership and domestic institutional ownership) on agency costs is not different when compared between firms with a stock price premium and firms with a stock price discount.

Table 2: Result of Price Spread Multi-Group SEM with Constrained Parameters

Structural Relationship	Stock Price Premium Sample		Stock Price Discount Sample	
	Unstandardized Regression Weight	Critical Ratio	Unstandardized Regression Weight	Critical Ratio
AC ← PFIOWN	-0.483	-7.195*	-0.483	-7.195*
AC← PDIOWN	-0.036	-0.457	-0.036	-0.457
AU ← AC	1.000		1.000	
OE ← AC	0.079	3.159*	0.079	3.159*
FCF ← AC	0.275	2.064	0.275	2.064
Goodness of Fit				
Chi Square	259.652			
Degree of Freedom	57			
Probability	0.000			
Chi Square/DF	4.555			
GFI	0.942			
AGFI	0.931			
RMR	0.006			
RMSEA	0.062			

AC: agency cost; PFIOWN: foreign institutional ownership; PDIOWN: domestic institutional ownership; AU: assets utilization; OE: operating expense and FCF: free cash flow. The coefficient of institutional ownership structure is the same between firms with stock price premium and stock price discount.) significant 10%*

Table 3 shows the test results by multi-group structural equation model with unconstrained parameters. The regression coefficient of ownership structure influence towards agency cost is not different when compared between firms with stock price premiums and discounts. Goodness of fit tests are presented in

Table 4 indicating the unconstrained parameter model (GFI= 0.976) is better for the model with constrained parameters (GFI= 0.942). In addition, a chi square value changes by 56,585 with four degrees of freedom demonstrating a significant difference ($\rho<0.10$). Therefore, the base model and alternative model based on the difference of stock price premium and discount are significantly different.

This indicates that the price spread condition is significantly influential as a moderating variable. Variance in moderation of the price spread condition appears primarily in the difference between foreign institutional ownership, domestic institutional ownership and agency cost on stock price premiums and discounts.

Table 3: Result of Price Spread Multi-Group Structural Equation Model with Unconstrained Parameters

Structural Relationship	Stock Price Premium Sample		Stock Price Discount Sample	
	Unstandardized Regression Weight	Critical Ratio	Unstandardized Regression Weight	Critical Ratio
AC← PFIOWN	-0.542	-3.267*	-0.946	-6.465*
AC← PDIOWN	-0.087	-0.785	-0.236	-1.463
AU ← AC	1.000		1.000	
OE ← AC	0.085	5.078*	0.098	4.842*
FCF ← AC	0.497	3.287*	0.096	0.823
Goodness of Fit				
Chi Square	203.067			
Degree of Freedom	53			
Probability	0.000			
Chi Square/DF	3.831			
GFI	0.976			
AGFI	0.943			
RMR	0.028			
RMSEA	0.067			

AC: agency cost; PFIOWN: foreign institutional ownership; PDIOWN: domestic institutional ownership; AU: assets utilization; OE: operating expense; and FCF: free cash flow. The coefficient of institutional ownership structure is the same between firms with stock price premium and stock price discount.) significant 10%*

Table 4: Comparison of Goodness of Fit from Base Model and Alternative Model of Price Spread

Goodness of Fit			
Indicator	**Base Model (constrained parameter)**	**Alternative Model (unconstrained parameter)**	**Criteria**
Chi Square	259.642	203.067	Low
Degree of Freedom	57	53	
Probability	0.000	0.000	> 0.05
Chi Square/DF	4.555	3.831	< 5
GFI	0.942	0.976	> 0.90
AGFI	0.931	0.943	> 0.90
RMR	0.006	0.028	< 0.03
RMSEA	0.062	0.067	< 0.08
Goodness of Fit Increase from Base Model to Alternative			
Chi Square	259.652 −203.067 = 56.585		High
Degree of Freedom	57 – 53 = 4		
Probability	Less than 0.005		< 0.05
Conclusion	Alternative model (unconstrained model) is significantly different from base model (constrained model) Thus, price spread (stock price premium and stock price discount) significantly moderates direct and indirect relationship between ownership structure (foreign institutional ownership, and domestic institutional ownership) and agency cost.		

Table 4 shows a comparison of test result between the base model (constrained model) and alternative model (unconstrained model). The goodness of fit value, chi square value and degree of freedom of both test models determine whether stock price premium and stock price discount have significantly different relationships. The table shows increase of goodness of fit values, from base model to alternative model. The chi square value changed 56,585 points, and degree of freedom changed 4 points. Based on the goodness of fit of base model and alternative model, the relationships between agency cost and performance is moderated by stock price premiums and stock price discounts.

Table 5 shows full model of SEM (Panel 1) and Multi-groups SEM (Panel 2). The result of full model SEM shows results consistent with negative coefficients however, the effect of domestic institutional ownership to agency cost is insignificant. The result of Multi-groups SEM shows coefficients consistent with the hypotheses. The SPP has lower negative magnitude than SPD.

Table 5: Comparison of Test Result Prediction

Panel 1: Unmoderated Full Structural Equation Model		
Relationship	**Result Prediction**	**Full SEM Result**
Agency Cost ← Foreign Institutional Ownership	Negative	-0.243*
Agency Cost ← Domestic Institutional Ownership	Negative	-0.378

Panel 2: Multi-group Structural Equation Model Moderated by Price Spread			
Relationship	**Result Prediction**	**Multi-group Result**	
		Stock Price Premium	**Stock Price Discount**
Agency Cost ← Foreign Institutional Ownership	SPD<SPP<0	-0.542*	-0.946*
Agency Cost ← Domestic Institutional Ownership	SPD<SPP<0	-0.087	-0.236

*Table 5 Panel 1 is a summary of predictions with results that utilizes full structural equation model with constrained parameters, and the unconstrained parameters model with stock price premium and discount as moderating variables. The results are consistent with predictions indicating a negative relationship. Nevertheless, the domestic institutional ownership and agency cost relationship is insignificant. Table 5 Panel 2 is a summary of the result predictions and empirical results utilizing multi-group structural equation model with stock price premium and discount moderating variables. The results of the study show that the coefficient value of stock price discount should be lower than the coefficient value of stock price premium. Ownership structure has a negative effect on agency cost however, the effect is less negative for firms with low agency conflict. *) significant 10%*

Table 6 shows a summary of the test results obtained in this study. Higher foreign institutional ownership implies lower firm agency costs. Foreign institutional ownership has a smaller negative effect on agency cost when firms are trading at a stock price premium. However, domestic institutional ownership has an insignificant effect on agency cost and the negative effect is statistically the same for stock price premiums and discounts. The result suggest that domestic institutional ownership has less influence on agency cost because domestic institutional owners usually have a majority ownership and a resulting superior control over managers and policies. Therefore, the conflict shifts from a principal agent conflict to a majority versus minority conflict.

Meanwhile, foreign institutional ownership usually has better internal control of their clients than domestic shareholders. Their investment in Indonesia usually involves a sophisticated governance mechanism and risk management practices because they bear more risks.

Table 6: Summary of Statistics and Hypotheses

Hypotheses	**SPP**		**SPD**	**Result*)**
Structural equation model on all study samples				
H_1: Foreign institutional ownership have negative influence towards agency cost	-0.542		-0.946	♣♣
H_3: Domestic institutional ownership have negative influence towards agency cost	-0.087		-0.236	♣
Structural equation model on stock price premium and stock price discount samples				
H_2: Foreign institutional ownership will affect agency cost negatively; lower when firm is in stock price premium than stock price discount.	-0.542	<	-0.946	♣♣
H_4: Domestic institutional ownership will affect agency cost negatively; lower when firm is in stock price premium than stock price discount.	-0.087	<	-0.236	♣

Table 7 summarizes the findings in this paper. The table shows results consistent with the research hypotheses however, two hypotheses are not significant in explaining the price spread phenomena to institutional ownership structure. A lower SPP effect means the negative magnitude i closer to zero than SPD. *)♣♣ indicates the *empirical result is consistent with the theoretical prediction and significant* ♣: indicates the empirical results is *not significant*

Further studies might reexamine the proxy for agency conflict magnitude. Other proxy's might produce different results. This will enrich the findings in this paper. Further studies might also examine other markets. The extent to which the findings ere can be generalized is not known.

CONCLUSION

This research analyses the bid and ask price spread as a measure of the divergence of opinion between buyer and seller of securities. This research argues that bid ask spreads are related to agency problems and the effect types of institutional ownership (foreign and domestic). This research uses Indonesian listed firm financial data and utilizes Structural Equation Modeling (SEM) with full model and multi-group model to test four hypotheses.

Research findings shows foreign and domestic institutional ownership have negative effect to agency cost. The result also confirms that the effect of types of institutional ownership to agency cost are lower for stock price premiums than discounts. The findings are mixed but generally consistent with research hypotheses. This research uses asset utilization and operational cost as proxy for agency cost. However, there are other proxy's suitable for agency cost, such as residual loss. Future research should also examine other markets.

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HOLDING PERIOD AND CROSS-SECTIONAL STOCK RETURNS: EVIDENCE FROM TAIWAN

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ABSTRACT

This paper employs a hybrid approach that combines an adapted version of Fama-MacBeth two-pass regression with Engle-Granger cointegration test to characterize the relationship between expected stock returns and systematic risks with diverse investment horizons. We find no evidence supporting a positive relationship between the market beta and return for various investment horizons. The book-to-market effect is sensitive to the investment horizon. We find a size effect for diverse investment horizons in period from 1986 to 1993. However, the size effect disappears in the subsequent period.

JEL: G11; G12

KEYWORDS: Asset pricing model, cointegration, holding period

INTRODUCTION

The relationship between expected return and systematic risk is still an important issue in the academic field and to practitioners, because consensus does not exist on how risk factors affect an asset's expected return. There is a long history of exploration on the issue. Among others, Black, Jensen, and Scholes (1972), and Fama and Macbeth (1973) found that market beta is the only factor in explaining an asset's return. Fama and French (1992, 1993) and Carhart (1997) provided evidences that factors other than market beta play an important role in explaining an asset's return. However, Kothari, Shanken, and Sloan (1995) claimed that market beta is still alive, and the relation between expected return and book-to-market is seriously exaggerated by survivor bias. The studies are ample and provide insights on the relationship between expected return and factors' risk, but they fail to consider the effect of investment horizon.

Levy and Spector (1996) stated that the investment horizon plays a crucial role in determining the optimum composition of an investment portfolio. Among others, Gunthorpe and Levy (1994) found that portfolio composition changes dramatically and systematically with changes in investment horizon. This is because changes in investment horizon can affect both the risk and return of the portfolio. Hawawini (1983) and Levy and Cohen (1998) provided evidence that stock risks change as the return interval is lengthened. The results imply that investors need to construct and evaluate their portfolios in a manner consistent with their planned investment horizons. However, they only considered the choice of return interval, for example, daily versus weekly, or monthly versus annually, and then examined the possible impact of the return interval on beta. Although Levy and Samuelson (1992) proved that the Capital Asset Pricing Model (CAPM) will hold in some cases under a diverse investment horizons, few studies have provided empirical evidence on how the investment horizon influences the relationship between systematic risks and expected return.

In this study, we modify the Fama-MacBeth approach to examine the effect of investment horizon on the return-risk relationship in the Taiwan Stock Exchange (TSE). To explore the investment horizon effect, we assume that an investor constructs a portfolio based on estimated betas, holds the portfolio for a number of months, and then sells it. By varying the holding period, we can explore the effect of investment horizon on the risk-return relationship. Specifically, we first estimate betas for each month,

and then use the average monthly returns for various investment horizons as a substitute for the next one-month return in the second-pass Fama-MacBeth cross-sectional regression. One question is whether use of the average return is justified, given that there could be unit roots in the average return, which is calculated by an overlapping technique. To tackle this spurious regression problem, we apply Engle and Granger's (1987) cointegration technique to determine whether there is a long memory relationship between the risk premium and average excess return on each expected factor. If a factor's risk can consistently explain the expected return, the risk premium, which is the slope coefficient obtained from running the Fama-MacBeth cross-sectional regression, should be equal to the expected excess return.

Our results showed that the relationship between the market beta and expected return is weak, no matter how long we hold the portfolio. This result contradicts the work of Levy and Samuelson (1992), which states that the CAPM holds for diverse investment horizons. After analyzing data for 12-, 24-, and 36-month holding periods, we found that the book-to-market value could explain the cross-sectional variation in expected stock returns only for a 24-month holding period. On the other hand, the size effect was significant no matter how long we held the portfolio. The results imply that the ability of the beta for a specific risk's factor to explain the cross-sectional variation in expected return varies with the investment period. The results are same as the work of Fama and French (1992, 1993) for American equity market, the work of Chui and Wei (1997) for Asian equity market, and the work of Ma and Shaw (1990) for the Taiwan equity market. However, these results have different implications, because their results can only be used for investors with short-run investment horizon. These results can help investors understand whether estimated betas are useful for predicting stock returns given different investment horizons. Meanwhile, the results also imply that investors with different investment horizons should have different equity allocations.

The next section contains a literature review. Methodology and data are outlined in Section 3 and 4. Section 5 provides an analysis of empirical results. Finally, some concluding remarks are provided.

LITERATURE REVIEW

The CAPM was developed by Sharpe (1964) and Treynor (1961) to determine an asset's price for risk. The only risk is market beta, which is covariance function of asset's return with market portfolio. Other factors play no role in determining an asset's price. The CAPM was tested by many researchers, including Friend and Blume (1970), Black, Jensen, and Scholes (1972), Miller and Scholes (1972), Fama and Macbeth (1973), Basu (1977), Banz (1981), and Stambaugh (1982), among others. Most empirical studies apply Fama and MacBeth (1973) two-pass regression approach to determine whether a specific risk's factor explains the cross-sectional variations in expected stock returns. For example, Fama and French (1992) provided evidences that the ratio of a firm's book-to-market value and firm size explain American stock returns far better than market beta. Chui and Wei (1998) found the same evidence for this phenomenon in five Pacific-Basin emerging markets. In particular, they applied monthly returns on listed common stocks and estimated market beta using a 60-month holding period. All of the stocks were then ranked by beta and placed into a certain number of portfolios. Next, the betas and returns of these portfolios are estimated for every rolling 60-month holding period. They projected the next one-month realized portfolio returns on the estimated portfolio betas. The design of using a portfolio instead of individual stocks can avoid measurement errors. Finally, the researchers use ordinary t-test to examine the relationship between returns and betas.

Most early studies found evidence in supporting the CAPM, including Friend and Blume (1970), Black, Jensen, and Scholes (1972), Miller and Scholes (1972), Fama and Macbeth (1973). However, other researchers found that factors other than market beta can explain a large portion of asset returns. Basu (1977) stated that low price/earnings portfolios have higher return than expected by CAPM. Basz (1981) found that firm size can play an important role in explaining firm's returns. Keim (1983) identified

seasonality in stock returns. Fama and French (1992, 1993) provided evidence that market, size, and book-to-market, are the only three equity's risk's factors. Moreover, controlling the size factor, the market beta lost its role in explaining an equity's expected return. Davis, Fama, and French (2000) also presented evidence that the positive relation between average return and book-to-market is strong. However, Kothari, Shanken, and Sloan (1995) challenged the results of Fama and French (1992, 1993) by claiming that the relation between expected return and book-to-market is seriously exaggerated by survivor bias. He et al. (1996) also found that size and book-to-market can only explain a small portion of the stock expected return. Downs and Ingram (2000) showed that average returns relate positively with market beta but not with size. In the bond market, Gebhardt, Hvidkjaer, and Swaminathan (2005) found that default beta is significantly related to the cross-section of average return.

Studies on the return-risk relationship are extensive, but most studies didn't consider the effect of investment horizons. Samuelson (1969, 1990, and 1994) proved that a optimal asset allocation is independent of the investment horizon. However, the work of Lloyd and Haney (1980) doesn't coincide with the argument of Samuelson. Lloyd and Haney pointed out that the volatility of a portfolio's value can be reduced by lengthening the holding period. This is the concept of time diversification. Gunthorpe and Levy (1994) and Levy and Spector (1996) found that optimal weights of risky asset are changed as investment horizon lengthens. Merrill and Thorley (1996) and Levy and Cohen (1998) also proved that lengthening the holding period could reduce risk. Moreover, Hawawini (1983) and Levy and Cohen (1998) found that stock's market betas change as the holding period is lengthened. The results imply that the relationship between an asset's returns and risk need further exploration for different holding periods.

Many studies have explored the return-risk relationship in the TSE. Among others, Ma and Shaw (1990) provided evidence that firm size and earnings to price can explaining expected returns. Huang (1997) found an inverse relationship between return and market beta. However, Chen (2003) indicated that the relationship between return and market beta was statistically significant. Sheu, Wu, and Ku (1998) and Ku (2005) suggested that market beta, volume, sales to price and momentum are better risk's factors in explaining asset's returns. Jan and Shiu (2008) also provided that an investor can be better off by holding risky assets over longer investment horizon. However, none of these studies considered the influence of investment horizons on the return-risk relationship in the TSE.

METHODOLODY

The motivation of our analysis is to determine whether the risk's factors are priced with a diverse investment horizon. The empirical models we study include the CAPM, 3-factor asset pricing model of Fama and French (1993), and 4-factor asset pricing model of Carhart (1997). All of these models are of the form

$$E(R_{it+1}) = \sum_{j=1}^{p} \alpha_{j,t+1} \beta_i^j \,, \tag{1}$$

where $E(\bullet)$ is the expectation operator; R_{it+1} denotes the excess return, the difference between the return on portfolio i and the risk-free return R_f at time $t+1$; $\beta_i^j = \text{cov}(R_i, R_j)/\text{var}(R_j)$ is the beta for factor portfolio j and α_{jt+1} is the corresponding expected risk premium at time $t+1$. The value of p determines the model represented in Equation (1), as follows. If $p=1$, then we have the CAPM, and the risk's factor is the market portfolio. If $p=3$, then we have the 3-factor asset pricing model, and the risk's factors are the market portfolio, size portfolio, and book-to-market ratio portfolio. If $p=4$, then we have the 4-factor asset pricing model, where the first three factors are identical to those in the 3-factor model, and the fourth factor is a one-year momentum portfolio. In all of the above models, the factors are systematic risks since idiosyncratic risks can be diversified away.

We modify the Fama and Macbeth's (1973) two-pass regression approach to investigate the relationship between the betas and expected returns on the factors. The original version of this approach involves three steps. First, a time series regression is used to estimate the betas β_i^j based on the previous 60 monthly returns for every portfolio. Second, a cross-sectional regression is performed on the expected returns $E(R_{it+1})$ for each month based on the betas β_{it}^j obtained at time t. Using the technique introduced by Fama and MacBeth and employed by later researchers, the next one-month realized excess return is used as a substitute for the expected excess return. That is,

$$R_{it+1} = \alpha_{0,t+1} + \sum_{j=1}^{p} \alpha_{j,t+1} \beta_{i,t}^j + \varepsilon_{t+1} , \quad (2)$$

where ε_{t+1} is an error term and $\alpha_{0,t+1}$ is a parameter associated with an intercept. Finally, the conventional t-statistics is used to test whether the time-series slope coefficients $\alpha_{j,t+1}(\alpha_{0,t+1})$ from the cross-sectional regression are different form zero at a conventional significance level.

A limitation of the original Fama-MacBeth approach is that it is not applicable to long holding periods. Each investor has her or his own planned investment horizon. For instance, some investors may prefer to invest for 12 months, while others may want to invest for 24 months. If we construct a portfolio based on the betas of the estimated factors and hold it more than one month, the next one-month return may not shed light on the relationship between the betas and the expected return. To more accurately characterize the effect of a long investment horizon, we substitute the average monthly return for the next one-month return in the second pass regression of Fama-MacBeth. This approach is similar to the work of Black, *et al.* (1972). However, they only regressed the average returns to the betas once. That is, in place of R_{it+1} in equation (2),

$$\overline{R}_{it+k} = \alpha_{0,t+k} + \sum_{j=1}^{p} \alpha_{j,t+k} \beta_{i,t}^j + \varepsilon_{t+k} , \quad (3)$$

where $\overline{R}_{it+k}$ is the k-month average excess return on portfolio i from month t to month $t+k$. In this study, k is either 12, 24, or 36 months. To increase the robustness of our sample, we employ overlapping holding periods. Specifically, if $k = 12$, the first monthly average excess return is calculated for the period from January 1986 to December 1986, the second is for the period from February 1986 to January 1987, and so on. Therefore, the data for monthly average return represents overlapping returns. The null hypotheses of the Fama-MacBeth approach are that the average slope coefficients are zero. If the null hypothesis is rejected for the beta of a given factor, then this factor has power to explain the cross-sectional variation in expected returns. However, the above results may produce spurious problems, because we use the overlapping approach to compute the monthly average returns, and the time-series average returns could have a unit root. In this case, the time-series slope coefficients estimated from Equation (3) would not be independent, and furthermore, could also have unit roots. The coefficient of correlation between the time-series slope coefficients (see Appendix) could approach unity. If the regressors which come from estimated time-series slope coefficients were not independent or had unit roots, according to the work of Fuller (1996), the conventional t-statistics could be biased due to the misestimated variance of estimator.

When we use long-run average returns, most time-series slope coefficients and moving average returns on factor portfolios cannot reject the hypothesis of a unit root. Nevertheless, if Equation (3) correctly describes the cross-section of average returns, then the slope coefficient is the corresponding factor's risk premium, (See for example, the work of Fama and French, 1993) which is equal to the expected excess return on the corresponding factor portfolio. That is,

$$\alpha_{jt} = E(R_{jt}) , \quad (4)$$

where R_{jt} denotes the excess return on factor portfolio j at time t. Therefore, the time-series slope coefficients and expected returns on the factor portfolio must have a long memory relationship. To determine whether such a long memory relationship holds, we use the average monthly return to estimate the expected return and apply a test by Engle and Granger (1987) to examine whether they are cointegrated. The test is performed as follows. First, we run the following regression:

$$\alpha_{jt+k} = \gamma_0 + \gamma_1 \overline{R}_{jt+k} + \xi_{jt+k}, \tag{5}$$

where $\overline{R}_{jt+k}$ is the k-month average excess return on factor portfolio j from month t to month $t+k$, α_{jt+k} is the corresponding cross-sectional slope coefficient obtained from Equation (3), γ_0 and γ_1 are the cointegration vector parameters, and ξ_{jt+k} is an error term. If both the time-series slope coefficients and the moving average excess returns have unit roots, rejection by the error term of the null hypothesis (unit root existence) implies that they are cointegrated. We also run the reversal regression, which regresses the average excess return on the time-series slope coefficient. The results are very similar to those of Equation (5). To save the space, we do not present the results here. However, they are available upon request to the author.

Data

To avoid the survival bias critique described by Brown et al. (1995), we include all stocks contained in the Taiwan Economic Journal (TEJ) from July 1982 to December 2005. The sample contains 602 stocks and 282 monthly observations. All the stocks in the TSE are included until they are delisted, even if a firm's book values are negative. This method is designed to avoid the problem of survival bias. We group the stocks into portfolios based on two criteria. First, we classify the stocks into 5 size categories based on their market values. Second, we classify each size category into 5 portfolios based on the book-to-market ratio of each firm. The result is 25 portfolios $P_{i,j}$, where $1 \le i \le 5$ represents size and $1 \le j \le 5$ represents book-to-market-ratio. Many studies have used this system of five size and book-to-market categories to examine the accuracy of a specific asset pricing model, because the resulting 25 portfolios are very hard to price correctly. See, for example, Fama and French (1993), and Daniel and Titman (1997).

In addition to the 25 portfolios, we include four special portfolios, each of which mimics a given risk's factor. The first is the Taiwan Weighted Index (TWI), which we use as the market portfolio. The risk-free rate is the one-month deposit rate at the First Commercial Bank. In an approach introduced by Fama and French (1993) and later used by Carhart (1997), we create three zero-investment portfolios, which measure the effect on simple average returns of three risk's factors. The first is size portfolio (SMB), which consists of the difference between the simple average returns of the smallest 40 percent market value portfolios and the simple average returns of the highest 40 percent market value portfolios. The second is value-growth portfolio (HML), which is the spread between the simple average returns of the highest 40 percent book-to–market ratio portfolios and the simple average returns of the lowest 40 percent book-to-market ratio portfolios. The last is one-year momentum portfolio (PR1YR), which is the difference between the simple average returns of the firms with the highest 40 percent lagged one month return and the lowest 40 percent lagged one month return.

Table 1 presents summary statistics for the 25 portfolios, sorted by size and book-to-market ratio. The statistics include the average monthly returns, the standard deviation of the monthly returns (shown in parentheses), the market value, and the book-to-market ratio for each portfolio. Panel A shows the market value weighted average monthly returns. Small market value portfolios have relatively high average

returns. Though a high book-to-market ratio does not guarantee higher average returns, on average the portfolios $P_{\bullet,1}$ and $P_{\bullet,5}$ with the lowest and highest book-to-market ratios have higher returns. On the other hand, the price of a high average return is generally a high standard deviation, as shown by the standard deviation figures in parentheses. Panels B and C show the market value and book-to-market ratio sample averages for each portfolio. In Panel B, the sample average for portfolio $P_{1,1}$ in the upper left hand corner is negative because we included stocks with a negative book value until they were delisted from the TSE. The other 24 portfolios show book-to-market ratios of less than one, with the exception of the high book-to-market ratio portfolios $P_{1,5}$, $P_{2,5}$ and $P_{4,5}$. The phenomena are very similar to other markets, such as the U.S. stock market documented by Fama and French (1992), the Japanese stock market documented by Jagannathan et al. (1998), the Pacific-Basin stock markets documented by Chui and Wei (1998), and international stock markets documented by Bauman et al. (1998) and Fama and French (1998).

Table 2 shows summary statistics for the four risk factor-mimicking portfolios. The average monthly returns vary from 0.556 percent for the book-to-market ratio portfolio to 1.858 percent for the one-year momentum portfolio. Interestingly, the one-year momentum portfolio has the lowest variation and the book-to-market ratio portfolio has the highest variation. Table 2 also presents the coefficients for risk factor cross correlations. The market factor has a low correlation with the other factors, suggesting that inclusion of factors other than the market factor may increase a model's power to explain the cross-section expected returns. By contrast, size factor displays a 0.451 correlation with book-to-market portfolio.

EMPIRICAL RESULTS

Table 3 presents the results of the Augmented Dickey-Fuller (ADF) Unit Root Tests. Panel A shows the results for the time-series slope coefficients estimated from Equation (3). The hypothesis of unit root existence was not rejected in most cases. There were rejections for three of the 12-month investment horizons: the market factor in the 3-, and 4-factor asset pricing models and the one-year momentum factor in the 4-factor asset pricing model. However, when the investment horizon rose above 12 months, the estimates of the time-series slope coefficients all can't reject the existences of unit root. Panel B displays the results for the moving average monthly returns of the factor portfolios. None of the tests rejected the unit root hypothesis.

Table 4 displays the results of the Engle-Granger cointegration tests. We only report the results when the unit root hypothesis has not been rejected for both the time-series slope coefficients and the moving average excess returns. When one variable is stationary and the other is not, the linear combination is nonstationary. Therefore, use of the cointegration test would be meaningless.

The results for the full sample are shown in Panel A, while those for the sub-sample are shown in Panel B and C. The first portion of Panel A presents the results for the CAPM, which show that we cannot reject the null hypotheses of unit root existence for the error terms from running Equation (5), implying that the time-series slope coefficient and the moving average excess returns of the market portfolio are not cointegrated. As a result, the market factor doesn't have the power to predict the expected return, implying that the CAPM cannot describe the return-risk relationship cross-sectional for a long investment horizon.

Table 1: Summary Statistics on the 25 Size and Book-to-Market Sorted Portfolios

Panel A: Average Monthly Return					
Portfolio	**Book-to-Market Ratio**				
Size	**Lowest**	**2**	**3**	**4**	**Highest**
Smallest	4.120	4.122	3.086	3.902	4.185
	(17.474)	(16.768)	(15.871)	(17.102)	(17.743)
2	3.401	2.824	2.911	3.093	2.811
	(14.737)	(14.020)	(14.011)	(14.892)	(15.262)
3	3.254	2.697	2.202	2.564	2.661
	(14.054)	(13.759)	(12.516)	(13.745)	(15.100)
4	2.748	2.421	1.612	1.914	2.756
	(13.113)	(12.484)	(12.238)	(11.920)	(13.995)
Largest	2.797	2.095	2.279	2.313	2.498
	(14.838)	(13.196)	(11.653)	(12.776)	(13.900)
Panel B: Average Market Value (Millions of Dollars)					
Smallest	2256.1	1920.6	1772.5	1770.6	1539.8
2	4553.3	3977.4	3388.8	3496.6	3355.5
3	10518.6	6443.5	7066.6	6113.5	5925.7
4	11093.8	10160.5	10673.2	10404.3	10179.7
Largest	78249.9	46192.1	38861.0	35818.5	43316.5
Panel C: Average Book-to-Market Ratio					
Smallest	-1.099	0.524	0.648	0.848	1.425
2	0.310	0.475	0.617	0.805	1.179
3	0.270	0.414	0.520	0.670	0.960
4	0.248	0.389	0.512	0.661	1.022
Largest	0.185	0.303	0.420	0.557	0.856

The data span from July 1982 to December 2005. The standard deviations appear in parentheses. The average returns and standard deviations are represented as percentages.

Table 2: Summary Statistics for the Risk Factor Portfolios

Factor Portfolio	**Average Return**	**Standard Deviation**	**Cross Correlation**			
			TWI	**SMB**	**HML**	**PR1YR**
TWI	1.618	11.867	1.00			
SMB	1.620	10.409	-0.085	1.00		
HML	0.556	12.569	-0.127	0.451	1.00	
PR1YR	1.858	6.207	0.066	0.023	0.164	1.00

TWI is return on the Taiwan value-weighted index. SMB, HML, and PR1YR are monthly returns on the value-weighted, zero-investment, factor-mimicking portfolios for size, book-to-market ratio, and one-year momentum in stock returns. The average returns and standard deviations are given as percentages.

The full sample results for the 3-factor asset-pricing model are shown in the middle portion of Panel A. The time-series slope coefficients and the moving average returns of the market portfolio are not cointegrated in either the 24- or 36-month investment horizon. The cointegration vector estimates in the 24-month investment horizon are negative, indicating an inverse relationship between return and market beta. When we increase the investment horizon to 36 months, the cointegration vector estimates become positive. On the other hand, the time-series SMB slope coefficients and moving average excess returns are cointegrated at the 5% significance level. Moreover, the cointegration vector estimates are positive and very close to one. The time-series HML slope coefficient is only cointegrated with the moving

average excess return in the 24-month investment horizon. The cointegration vector estimates are also positive and close to one.

Table 3: Augmented Dickey-Fuller Unit Root Tests

Panel A: Cross-Sectional Slope Coefficients for Fama-Macbeth Regression					
Model	Horizon	α_{TWI}	α_{SMB}	α_{HML}	α_{PR1YR}
CAPM	12	-3.061	---	---	---
	24	-1.282	---	---	---
	36	-1.202	---	---	---
3-factor asset pricing model	12	-4.660*	-1.962	-2.619	---
	24	-3.353	-1.719	-2.189	---
	36	-2.857	-1.710	-2.108	---
4-factor asset pricing model	12	-4.550*	-1.9042	-2.582	-3.523*
	24	-3.342	-1.581	-1.569	-2.907
	36	-2.140	-1.534	-2.142	-2.218
Panel B: Time-Series Excess Returns for the Factor Portfolios					
Horizon		TWI	SMB	HML	PR1YR.
12		-3.110	-2.448	-1.982	-1.322
24		-3.392	-1.516	-1.924	-1.507
36		-3.111	-2.435	-1.978	-1.184

*The unit root tests are conducted with both constant and trend. We don't report the lags, which are based on BIC criteria, and are available upon request. * denotes the 5% significance level. The horizon is the number of months the portfolio is held.*

The bottom portion of Panel A displays the full sample results for the 4-factor asset pricing model. Again, the time-series slope coefficient for the market portfolio does not cointegrate with the moving average excess return. On the contrary, the time-series slope coefficients and moving average returns of the SMB are cointegrated for diverse investment horizons. Furthermore, the cointegration vector estimates are also close to one. The slope coefficient and moving average return for the HML portfolio are also cointegrated for the 12- and 24-month investment horizons. The moving average return and the time-series slope coefficient for the PR1PR portfolio are not cointegrated. The cointegration vector estimates are negative, indicating that the beta of the one-year momentum portfolio cannot explain the cross-section of the average returns in the TSE.

Panel B and C present the results for the two sub-samples. The first sample is from July 1986 to December 1993 and the second is from January 1994 to December 2005. The sub-samples are designed to test whether our results are robust in different periods. The results of first sample are same as the full sample, implying a strong size effect for the long investment horizon in the period from July 1986 to December 1993. However, the strong size effect disappears in the second sub-sample, implying that we can't use the size premium to predict the long horizon expected returns. These results are similar to the works of Ferson and Harvey (1999), which showed that the size effect couldn't pass the robust diagnosis. In summary, our results imply that size has power in explaining the return-risk relationship in period from July 1986 to December 1993. The effect of book-to-market ratio on a stock's expected return varies with the investment horizon. The market factor and the one-year return momentum do not provide explanatory power for the expected return cross-section in the TSE.

Table 4: Engle-Granger Cointegration Tests

Panel A: Full Sample (1982/7~2005/12)

Model		TWI	SMB	HML	PR1YR
CAPM	12	-2.407 (-0.027 –0.528)	---	---	---
	24	-1.249 (-0.023 -0.467)	---	---	---
	36	-2.254 (-0.015 1.393)	---	---	---
3-factor asset pricing model	12	NA.	-4.250* (-0.001 0.856)	-5.242 (-0.006 1.085)	---
	24	-3.442 (-0.001 -0.255)	-3.595* (-0.005 0.976)	-5.008* (-0.007 1.010)	---
	36	-2.958 (-0.000 0.122)	-3.991* (0.002 0.725)	-3.208 (-0.006 0.408)	---
4-factor asset pricing model	12	NA.	-4.215* (-0.002 0.915)	-3.728* (-0.006 0.938)	NA.
	24	-3.353 (-0.002 –0.236)	-4.097* (-0.005 1.011)	-3.908* (-0.006 0.787)	-3.352 (0.002 -0.276)
	36	-2.481 (-0.002 0.381)	-3.465* (0.002 0.722)	-2.320 (-0.004 0.291)	-2.353 (-0.002 -0.085)

Panel B: Sub-sample (1982/7~1993/12)

Model		TWI	SMB	HML	PR1YR
CAPM	12	-3.389	---	---	---
	24	-1.987	---	---	---
	36	-3.554*	---	---	---
3-factor asset pricing model	12	NA	-4.413*	-4.422*	---
	24	-2.635	-3.814*	-5.421*	---
	36	-2.459	-5.025*	-2.451	---
4-factor asset pricing model	12	NA	-4.683*	-2.859	NA.
	24	-2.813	-4.243*	-4.038*	-2.762
	36	-2.188	-4.763*	-2.352	-2.208

Panel C: Sub-sample (1994/1~2005/12)

Model		TWI	SMB	HML	PR1YR
CAPM	12	-0.841	---	---	---
	24	-0.062	---	---	---
	36	-0.901	---	---	---
3-factor asset pricing model	12	NA	-2.967	-3.164	---
	24	-2.430	-1.547	-2.104	---
	36	-2.056	-1.026	-1.152	---
4-factor asset pricing model	12	NA	-2.857	-2.775	NA.
	24	-2.688	-1.486	-1.839	-2.378
	36	-1.800	-1.071	-1.392	-1.693

*The cointegration vectors are shown in parentheses, where the former value represents the constant. The conintegration vectors are not shown in panel B and C to save the space. NA signifies that one variable is stationary and the other is nonstationary. Therefore, use of the Enger-Granger test would be meaningless. * denotes the 5% significance level.*

CONCLUSION

This paper modifies Fama-MacBeth cross-sectional approach to examine the relationship between expected stock returns and systematic factor's risks with diverse investment horizons in the Taiwan Stock Exchange. If a specific risk's factor is important to describe the cross-sectional variation of expected returns, the estimated risk premium should equal its expected risk premium. That is, these two time-series data should cointegrate with each other. Therefore, we can examine whether a specific risk's factor has power in explaining return-risk relationship by use of the Engle-Granger test. We find no evidence in supporting a positive relationship between market beta and return. The size effect with various investment horizons just exists in the period from July 1986 to December 1993. The book-to-market effect is sensitive to the investment horizon. Meanwhile, including the return on one-year momentum does not improve the ability to explain the cross-section of average returns in the TSE. Our results show that the effect of a specific risk's factor on expected return depends on the investment horizon, which implies that investors with different investment horizons should have different equity allocations. Our modified method links the expected stock returns to candidated factors' risks in the long investment horizon. However, only four factors are examined. Moreover, the four factors are tested separately. Some comovements between factors may be ignored. Therefore, including more candidate factors and using a multivariate cointegrated method would improve the empirical evidences. We leave these issues for further research.

APPENDIX

Equations (2) and (3) can be rewritten as:

$$R_{t+1} = \beta_t \alpha_{t+1} + \varepsilon_{t+1}, \tag{A1}$$

$$\overline{R}_{t+k} = \beta_t \delta_{t+k} + u_{t+k}, \tag{A2}$$

where β_t is the factor's beta vector, α_{t+1} and δ_{t+k} are the estimated slope coefficient's vectors, and ε_{t+1} is the unexpected return with mean $E\{\varepsilon_{t+1}) = 0$, variance $\sigma^2(\varepsilon_{t+1}) = \sigma^2$, and covariance $Cov(\varepsilon_t, \varepsilon_{t+1}) = 0$. From (A1) and (A2), we can show that the surprise return u_{t+k} is the average of the error terms; i.e.,

$$u_{t+k} = \frac{1}{k}\sum_{i=1}^{k} \varepsilon_{t+i}. \tag{A3}$$

It follows that time-series surprise return u_{t+k} is autocorrelated. In particular, the covariance between u_{t+k} and u_{t+k+1} equals

$$Cov(u_{t+k}u_{t+k+1}) = \frac{k-1}{k}\sigma^2. \tag{A4}$$

Under the assumption that the regressor β_t is uncorrelated with u_{t+k}, we can use an ordinary least square method to estimate the parameters δ_{t+k} and their variance

$$\hat{\delta}_{t+k} = (\beta_t'\beta_t)^{-1}\beta_t'\overline{R}_{t+k}, \tag{A5}$$

$$Var(\hat{\delta}_{t+k}) = \frac{\sigma^2}{k}(\beta_t'\beta_t)^{-1}. \tag{A6}$$

It can also be shown that the covariance and the coefficient of correlation between $\hat{\delta}_{t+k}$ and $\hat{\delta}_{t+k+1}$ are

$$Cov(\hat{\delta}_{t+k}\hat{\delta}_{t+k+1}) = \frac{(k-1)\sigma^2}{k^2}(\beta_t'\beta_t)^{-1}\beta_t'\beta_{t+1}(\beta_{t+1}'\beta_{t+1})^{-1}, \tag{A7}$$

$$\rho(\hat{\delta}_{t+k}\hat{\delta}_{t+k+1}) = \frac{k-1}{k}(\beta_t'\beta_t)^{-1/2}\beta_t'\beta_{t+1}(\beta_{t+1}'\beta_{t+1})^{-1/2}. \tag{A8}$$

The coefficient of correlation between $\hat{\delta}_{t+k}$ and $\hat{\delta}_{t+k+1}$ may approach unity when the investment horizon k is large.

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AN EMPIRICAL STUDY OF VOLATILITY AND TRADING VOLUME DYNAMICS USING HIGH-FREQUENCY DATA

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ABSTRACT

This paper examines the dynamic relationship of volatility and trading volume using a bivariate vector autoregressive methodology. This study found bidirectional causal relations between trading volume and volatility, which is in accordance with sequential information arrival hypothesis that suggests lagged values of trading volume provide the predictability component of current volatility. Findings also reveal that trading volume shocks significantly contribute to the variability of volatility and then volatility shocks partly account for the variability of trading volume.

JEL: C01, G0, O16, O30

KEYWORDS: Trading volume; Volatility; Sequential information arrival hypothesis; Mixture of distribution hypothesis

INTRODUCTION

Four relevant information theories in the literature relate volume and volatility, namely, the mixture of distributions hypothesis (MDH), the sequential arrival of information hypothesis (SAIH), the dispersion of beliefs hypothesis, and the noise trader hypothesis. Information mainly determines the theories of volume and volatility. For example, according to the MDH, information dissemination is contemporaneous. Stock prices and trading volume change only when information arrives and evolve at a constant speed in event time. MDH suggests that daily price changes and trading volume are driven by the same underlying information flow. MDH implies only a contemporaneous relationship between volume and returns. The SAIH argues that each trader observes information sequentially. Hence, different types of traders will receive information sequentially. The econometric results show that past trading volume provides information on current volatility or absolute returns. Several studies find that a positive correlation exists between volume and volatility, including Lee and Rui (2002), Andersen (1996), Manganelli (2005), Xu et al. (2006) and Kim (2005). This investigation studies the dynamic relation between return volatility and trading volume on the Taiwan stock market.

This study differs, as follows, from other studies on the volume-volatility relationship. First, in this paper the measure of volatility is calculated by the sum of intraday 1-min returns. Minute-by-minute transaction data are used. The economic rationale is as follows: Martens (2002) shows the sum of squared intraday and intranight returns are better than using the daily return to measure stock market volatility. Andersen et al. (1999) and Martens (2001) show that intraday returns can improve not only measuring of volatility, but also the forecasting of volatility. The removal of microstructure bias makes the results in this paper more reliable. Second, in addition to using a vector-autoregressive (VAR) model to answer the question about the relationship of trading volume-volatility, The VAR model can consider the endogeneity of volume-volatility relations and capture the impact of volume (volatility) shock on volatility (volume) in the Taiwan stock market. The proposed model also provides the dynamic intraday-volume relation. Third, this paper reveals a volume-volatility relationship from the Taiwan stock market, whereas most empirical studies come from developed countries. Therefore, results from this study can complement and contrast with previous studies to assess whether the volatility-volume relationship is robust in different markets.

Empirical results show a significant relationship between the past trading volume and return volatility and current trading volume or volatility. The causality tests show a clear bidirectional relationship between

trading volume and return volatility. Our results support the SAIH. The findings presented in this study demonstrate that the shock to trading volume has a significant effect on volatility. The contribution of trading volume shock to the variability of volatility accounts for 40%. Only about 8% of changes in volatility can be attributed to the shock in trading volume. The impulse response function shows that one standard deviation increase in trading volume is followed by an increase in volatility. As regards the effect on trading volume, there is a downward effect of a shock to volatility. Trading volume responds much more sluggishly.

The remainder of this paper is organized as follows. Section 2 briefly reviews prior literature. Section 3 discusses the empirical model and estimation methodology. Section 4 describes the data. Section 5 provides the main results including results from the analysis of regression parameters, the Granger causality test, variance decomposition (VDC) and the impulse response function (IRF). Section 6 concludes the study.

LITERATURE REVIEW

Much literature exists on volatility-volume relationships in the stock market microstructure. Since the original work by Clark (1973), Epps and Epps (1976), and Harris (1986), a number of empirical papers have examined different aspects of the linkage between trading volume and volatility. Grammatikos and Saunders (1986), in early studies, found that price variability and trading volume are positively correlated in futures markets. More recently, Wang and Yau (2000) report evidence of a positive relation between trading volume and price volatility in futures markets. For a VAR Framwork, Garcia, Leuthold and Zapata (1986) document a lead-lag relationship between trading volume and volatility. Luu and Martens (2003) use US stock index futures market data and find a bi-directional causal relationship between volatility and trading volume. Xu et al. (2006) and Manganelli (2005) also find a strong contemporaneous and dynamic relationship between volume and volatility. However, some dissimilar results also appear in previous literature. For example, Pilar and Rafael (2002) argue that a decrease in volatility and increases trading volume. Watanabe (2001) suggests there is no relationship between price volatility and volume. The dynamic relationship between trading volume and volatility is unclear that depend on the market and time period we studied

Some studies consider the various types of trader volume and volatility. For example, Daigler and Wiley (1999) employ type of trader volume to study contemporaneous volume-volatility relationships. They primarily focus on the theory of sequence of information arrival and how different types of traders interpret and react to information. Chen and Daigler (2008) provide an integrated picture of the volume and volatility relationship by investigating the dynamic linear and nonlinear associations between volatility and the volume of informed and uninformed traders. The results of Chen and Daigler (2008) shows a one-way Granger causation from volatility to volume. Informed traders react less to lagged information than do uninformed traders for the sequential arrival of information framework, and public's trading volume creates excess volatility. Chen (2007) uses the data of four futures markets to investigate the effect of trader types on the intraday volatility-volume relationship. Chen's (2007) results from a VAR model show that the dynamic volatility-volume relationship depends on the trader types involved. The positive contemporaneous volatility-volume relationship is driven mainly by volume from trading between floor traders and customers. Alternatively, several studies focus on the effect of expected and unexpected volume shocks on volatility. Bessembinder and Seguin (1993) find that unexpected volume shocks have a larger effect on volatility in futures markets than expected volume. Daigler and Wiley (1999) find that the unexpected volume series is more important than the expected volume series in explaining volatility.

DATA

The data of the current empirical study consists of Taiwan stock exchange (TWSE) (http://www.twse.com.tw/ch/index.php) index transaction prices (represented by market index) and trading volume for the period 1st January 2005 to 31 December 2007. This study derives the daily trading

volume from the TWSE database. There are 743 days (observations) in our sample. Andersen et al. (1999) and Martens (2001) show that intraday returns can improve not only the measuring of volatility, but also the forecasting of volatility. Therefore, our empirical analyses use intraday returns from each 1-min interval to measure returns and avoid market microstructure problems. There are 65310 intraday 1-min interval trading data in our sample. The continuously compounded returns of every minute are calculated as $r_{i,t} = 100 \times (\log(P_t) - \log(P_{t-1}))$, where $r_{i,t}$ and P_t are the return and market index at time t.

The daily returns are computed as $R_i = \sum_t r_{i,t}$.

Unfortunately, volatility is not directly observable. A popular approach to measure daily volatility is to use the daily squared return. Andersen and Bollerslev (1998) argue that in most financial applications, the asset price is assumed to follow a continuous time diffusion process, and the correct measure for daily volatility is

$$\sigma_t^2 = \int \sigma_{t+\tau}^2 d\tau \qquad (1)$$

Andersen and Bollerslev (1998) show that the daily squared return is an unbiased estimator of true volatility. Martens (2002) also compares various measures and forecasts of volatility in daily volatility and find the best daily volatility measure is the sum of intraday squared returns. This implies that using the sum of squared intraday returns is better than using daily squared returns to measure stock market volatility. Hence, we use equation (1) to compute volatility. Table 1 provides basic statistics of volatility and trading volume.

Table 1: Basic Statistics of Sample

	Volatility(σ_t)	**Trading Volume(v_t)**
Mean	0.0004	15.104
Median	0.0007	15.086
Maximum	0.0512	16.157
Minimum	-0.0467	14.458
Standard deviation	0.0107	0.303
Skewness	-0.692	0.489
Kurtosis	4.0351	3.031

Note: The basic statistics of volatility (σ_t) and trading volume (v_t) are presented in this table. For the volatility, we analyzed with 1-minute intervals. Trading volumes, measured by nature logarithm, are from the TWSE database. The descriptive statistics have some clues for the behaviors of Taiwanese stock market.

RESEARCH METHODOLOGY

The VAR approach provides a framework and has been used widely in the literature for the issue in our research (e.g. Luu and Martens (2003), and Fujihara and Mougoue (1997)). VAR modeling requires that all times series be stationary. As a first step, trading volume and volatility and their first differences were tested for stationarity using Augmented Dickey-Fuller tests. If the calculated ADF statistic is less than its critical value, then the variable is said to be stationary or integrated to the order zero. If they are non-stationary, then the issue is to what degree they are integrated. In practice, a number of econometric packages can perform this test, which gives the critical value of the ADF statistic. Computations were performed using Eviews 6.0 and the number of lags or augmentation in ADF regressions were selected by Akaike Information Criterion. Table 2 lists the conclusion.

As a result, the following VAR(k) model is estimated, in which the Akaike Information Criterion (AIC) is

used to determine the optimal lag length (k). The VAR model used in this study is shown in equation (2) and (3) below.

$$\sigma_t = c_0 + \alpha_1\sigma_{t\text{-}1} + \alpha_2\sigma_{t\text{-}2} + \beta_1 v_{t\text{-}1} + \beta_2 v_{t\text{-}2} + \varepsilon_{1t} \quad (2)$$

$$v_t = a_0 + a_1 v_{t\text{-}1} + a_2 v_{t\text{-}2} + b_1\sigma_{t\text{-}1} + b_2\sigma_{t\text{-}2} + \varepsilon_{2t} \quad (3)$$

Where σ_t is the vector that represents the volatility and v_t is the vector that represents the trading volume. The optimal lag length (k) in the VAR model is selected by the Akaike Information Criterion (AIC) (i.e., $k = 2$).

The next step is to determine the direction of Granger causality. Under the assumption of stationarity of variables and the null hypothesis of no Granger causality, the standard F-test is used to examine Granger-causality between variables in the VAR system. If the F-test rejects the null hypothesis that the lag coefficients of variable v_t (σ_t) are jointly zero when variable σ_t (v_t) is the dependent variable in the VAR system, then variable v_t (σ_t) Granger-causes variable σ_t (v_t).

Once the VAR system was estimated, this study employed two short-run dynamic analyses: variance decomposition and impulse response functions. Forecast error variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR system. The variance decomposition is an estimate of the proportion of the movement of the n-step-ahead forecast error variance of a variable in the VAR system that is attributable to its own shock and that of another variable in the system. However, the recursive ordering of the variables in the VAR system for this study follows this order. Volatility is first and trading volume is ordered next to volatility. The ordering reflects previous studies such as Chen and Daigler (2008). Forecast error variance decomposition can characterize the dynamic behavior of a VAR system. In addition, we derive impulse response functions, which show the dynamic effects on volatility (trading volume) of innovations to the trading volume (volatility). We estimate the VAR model and orthogonalize these shocks by resorting to a Choleski decomposition of the estimated variance-covariance matrix of the VAR residuals to generate impulse response functions. Figures 1 and 2 list the results.

ESTIMATION RESULTS

As the first step, all the two variables were tested for stationarity using Augmented Dickey-Fuller tests. Table 2 gives the results. It can be seen that for all of the level variable less than critical value at 95% level of confidence. An examination of test results shows that all the time series employed in this research are stationary at level. The null hypothesis of the unit root is rejected for all variables at the 5% significance level.

Table 2: ADF Tests for Unit Roots

Variable	**Without trend**		**With trend**	
	Test statistic	Critical value	Test statistic	Critical value
Volatility(σ_t)	-3.649	-2.865	-3.999	-3.416
Trading volume(v_t)	-3.613	-2.865	-4.028	-3.416

Note: σ_t and v_t represents volatility and trading volume, respectively. Computations were performed by using Eviews 6.0 and the number of lags or augmentation in ADF regressions are selected by Akaike Information Criterion. The ADF test rejects the null of a unit root for both series in this table.

Table 3 shows the VAR estimation results. Results indicate that the past trading volume and volatility significantly affect the current volatility or trading volume. This conclusion is very important as it gives

useful information about trading volume and forecasts of returns and volatility. Table 4 presents causality test results obtained by VAR estimation using equations (1) and (2). The results indicate the trading volume of the Taiwan stock index significantly Granger-causes volatility. Volatility also strongly Granger-causes the trading volume of the Taiwan stock index. Furthermore, the Granger-causality between two variables is in both directions. The results also show the past market information about volatility and trading volume has an ability to predict the volatility and trading volume in the future in Taiwan. According to some theoretical papers, both the MDH and the sequential arrival of information hypothesis support a positive and contemporaneous relationship between trading volume and absolute returns. Our results supports the mixture of distributions hypothesis (MDH). Furthermore, a bi-directional causality test was found between volatility and trading volume, which is consistent with the findings of Luu and Martens (2003) and Chen (2007).

Table 3: VAR Estimation Results

Dependent variable	σ_t	v_t
Constant	-6.82E-06	303898.7
	(-3.5497)***	(4.1735)***
σ_{t-1}	0.9029	-7.52E+09
	(24.5974)***	(-5.4091)***
σ_{t-2}	0.0675	7.14E+09
	(1.8581)*	(5.1885) ***
v_{t-1}	5.80E-12	0.6166
	(6.2697)***	(17.6085)***
v_{t-2}	-3.08E-12	0.3154
	(-3.2616)***	(8.8062)***

*Note: 1. σ_t and v_t represents volatility and trading volume, respectively. 2. t statistics are indicated in the parentheses. 3. "***", "**" and "*" indicate significance at the 1, 5 and 10 percent levels, respectively.*

Table 4: Granger Causality Tests for Volatility and Trading Volume

Causality relation	**Statistics**	**P-value**
$\sigma_t \rightarrow v_t$	29.393	0.000(<5%)***
$v_t \rightarrow \sigma_t$	59.371	0.000(<5%)***

*Note: 1. σ_t and v_t represents volatility and trading volume, respectively. 2. $\sigma_t \rightarrow v_t$ means the volatility Granger-causes volume. $v_t \rightarrow \sigma_t$ denotes the volume Granger-causes volatility. 3. "***" represents the causal relationship being significant at 1% level.*

Table 5 illustrates the estimation results of variance decomposition to examine dynamic relationships in volatility and trading volume further. In Table 5, the stock volatility variance decomposition analysis reveals that the largest share of shock to volatility, apart from its own shock, trading volume accounted for about 40% during the 24-day period (about one month), while trading volume accounted for 21% of the shock during the 12-day period (about two weeks). The shock to trading volume has a significant effect on volatility. In addition, the movement in trading volume is explained by its own shocks rather than by the shocks to volatility. Clearly, volatility does not explain a large part of the variance decomposition of trading volume. The variance of volatility accounts for approximately 6% during the 4-day period and 8% in the 24-day period. This shows the small proportion of volatility shocks on the variability of trading volume.

Table 5: Estimates of Variance Decomposition

Lags (n)	Percentage of the movement in the σ_t explained by shocks to :		Percentage of the movement in the v_t explained by shocks to :	
	σ_t	v_t	σ_t	v_t
1	100	0	0.703	99.297
4	94.681	5.319	5.705	94.295
8	87.050	12.950	6.658	93.342
12	78.820	21.180	7.185	92.815
16	71.269	28.731	7.559	92.440
20	64.867	35.133	7.842	92.158
24	59.654	40.346	8.059	91.941

Note: σ_t and v_t stand for the volatility of Taiwan market index and trading volume, respectively. To further examine dynamic relationships in σ_t and v_t, this table provides the percentage of the movement in the σ_t explained by shocks to v_t and the percentage of movement in the v_t explained by shocks to σ_t.

The second use to which we put the VAR model was the derivation of impulse response functions, which show the dynamic effects between volatility and trading volume. Figure 1 and 2 depict the estimated impulse response functions. The time horizon extends to 30 days, over which the dynamic adjustment paths of volatility are plotted following the innovations to each of the trading volumes. One standard deviation increase in the trading volume is followed by an increase in the volatility. The effects on volatility peak after 17 days. As regards the effect on trading volume, there is a downward effect of a shock to volatility. Trading volume responds much more sluggishly. One standard deviation increase in volatility is followed by a decrease in the trading volume. The effect on trading volume peaks after 3 days. The results in Figures 1 and 2 show that past information about trading volume has an ability to predict volatility.

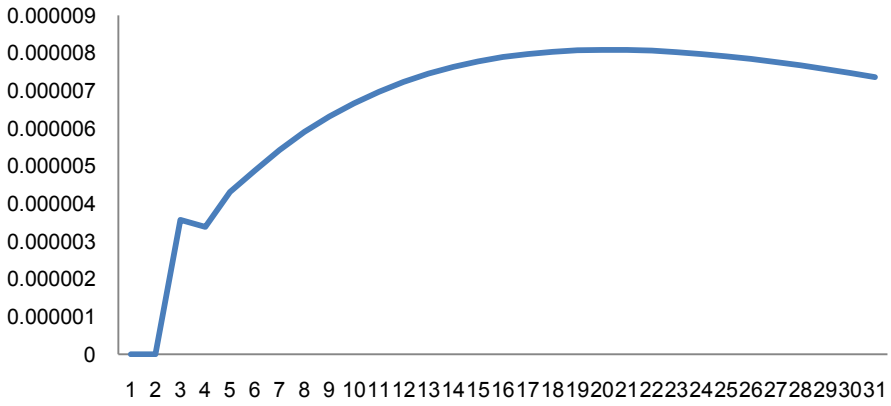
CONCLUSION

This paper aimed to investigate the dynamic relations between return volatility and trading volume on the Taiwan stock market. The use of the VAR model allowed us to trace the predictability of volatility and trading volume, and to account for the endogeneity between volatility and trading volume. The VAR model also enabled us to capture the economic interactions between those variables. We used intraday returns to measure volatility and avoid microstructure bias. This paper sheds further light on the dynamics between volatility and trading volume. First, we found a general bi-directional causal relationship. Because past market information about volatility and trading volume has an ability to predict volatility and trading volume in the future, our results supports both the mixture of distributions and the sequential arrival of information hypotheses.

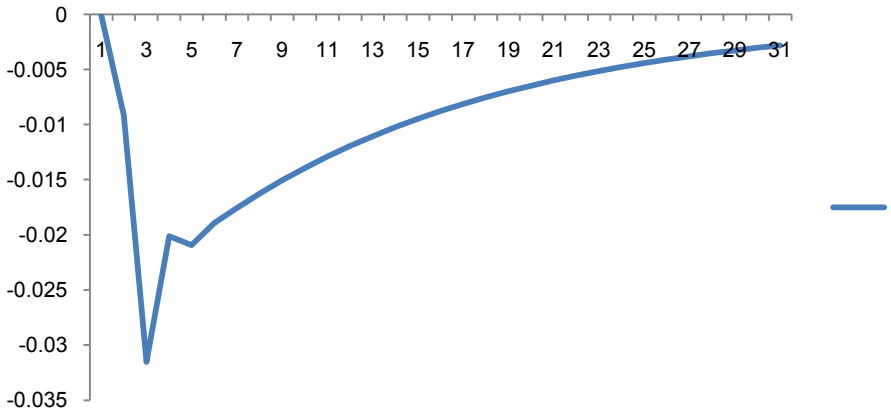
The forecast error variance decomposition was obtained with the aim of assessing how much such shocks contribute to the variability of the variables in the system. The result shows the trading volume shocks significantly contribute to the variability of volatility by accounting for about 40% of the shock during the 24-day period. However, the contribution of volatility shocks to the variability of trading volume only accounts for 8% of the shock during the 24-day period. This finding confirms that the variability in stock volatility is substantially explained by trading volume.

Figure 1:Estimation of Response Function

Response of σ_t to v_t



Response of v_t to σ_t



Note: σ_t and v_t represents volatility and trading volume, respectively. The impulse response function show responses of each variable in the VAR system to a one standard deviation shock to itself and to the other series. In this figure, the dynamic interrelation of σ_t and v_t can be shown.

The findings from the impulse response function show that one standard deviation increase in the trading volume is followed by an increase in the volatility. The effect on volatility peaks after 17 days. As regards the effect on trading volume, there is a downward effect of a shock to volatility. Trading volume responds much more sluggishly. One standard deviation increase in volatility is followed by an increase in trading volume. The effect on trading volume peaks after 3 days. These findings are helpful to financial managers dealing with the stock index or its derivations. The limitations to our model is sample size, additional research needs to collect different types of traders' data. The different types of traders may have distinct information. Recently, many studies begin to investigate SAIH to focus on the effect of different types of trader. Therefore, further results should need samples that are more detailed and many kinds of trader judgments.

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RELATIONSHIPS AMONG FOREIGN INSTITUTIONAL INVESTMENTS, STOCK RETURNS AND CURRENCY CHANGE-OVER RATES IN INDIA

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ABSTRACT

India from a conservative macroeconomic policy has gradually shifted focus towards attracting foreign capital. From September 14, 1992, with suitable controls, it allowed foreign investors to invest in primary and secondary capital markets in India and foreign funds started flowing from the year 1993. Foreign Institutional Investments has steadily grown from $11,268 million in March 2000 to $62,464 million in July 2009. Foreign fund flow increases demand for good stocks causing upward movement in stock prices. Currency changeover rates also influence foreign investments as Foreign institutional investors calculate returns in foreign currencies. In this study, we explored relations between foreign investment in India with that of stock prices in the domestic market and domestic currency changeover rates. Using daily data for the period January 2000 to July 2009, the study examined cause-effect relations and long-term relations among the series. Most of the studies in Indian market reported that domestic stock returns attract foreign fund flows but foreign flows do not cause stock returns in India. The results of this study using data for past nine and half years however detected bidirectional causality.

JEL: E44; G15

KEYWORDS: Causality, Cointegration, Foreign Institutional Investment

INTRODUCTION

Over the past few years, India has become a favored destination of global investors' stock investment. Foreign investments in India comes into two types: investment by foreign institutional investors (FII) made in secondary financial markets and foreign direct investment (FDI). In developing countries, enough capital is not readily available for expansion or developing new projects and thus foreign investment becomes a major source of funding for financing assets. Foreign investments made in secondary markets adds depth and liquidity to secondary markets. Further, there is an increased demand for foreign exchange in developing economies. Flow of foreign money provides much-needed foreign exchanges for the economy.

Foreign investments adds to domestic investment without increasing the foreign debt of the country. Foreign investments may perhaps increase stock prices, reduce cost of capital, and encourage investment by Indian firms. Foreign investors also speed up domestic reforms towards improving the market design of the securities markets, and strengthen corporate governance.

Currency changeover rates also influence foreign investments in domestic markets. FIIs calculate returns in foreign currency thus; return in dollar terms depends on the return on their investment in rupee terms and the currency changeover rate of the rupee and dollar. Depreciation of the rupee in the currency market can decrease return of foreign investor. For example, a 10 percent rupee return with a 5 percent depreciation of the rupee results in an effective dollar rate of return of about 5 percent. In the same way, a low rupee rate of return can be attractive in dollar terms if the rupee increases against the dollar. Therefore, FII investments are likely to go up (down) when there are prospects of domestic currency appreciation (depreciation). The objective of the study is to capture relations among FII investment, stock prices and exchange rates.

The remainder of the paper is organized as follows. Section 2 describes flow of foreign investments in India. Section 3 surveys the literature on how flows of foreign money influence domestic stock prices.

Section 4 describes methods used and draws a 'vector error correction model' using data from the year 2000 onwards and finally, section 5 provides some concluding comments.

FII INVESTMENT IN INDIA

India is the fifth largest economy in the world and has the third largest GDP in the continent of Asia based on purchasing power parity. It is also the second largest among developing nations and one of the few markets in the world, which offers high prospects for growth and earning potential in almost all areas of business. European investors believe that India is a good investment destination despite political turmoil, bureaucratic hassles, shortages of power and infrastructural bottlenecks.

Before 1980s, achieving self-reliance and reducing dependence on imports was the development approach of India. Debt and development aid provided fund needs for meeting budget shortfalls. It discouraged foreign investment or private commercial flows. Reforms introduced in the early 1990s, caused a gradual shift towards attracting foreign capital. From September 14, 1992, with suitable controls, foreign institutional investors (FIIs), nonresident Indians (NRIs), and people of Indian origin (PIOs) can invest in the primary and secondary capital markets in India through the portfolio investment scheme (PIS). Under this scheme, FIIs and NRIs can buy shares and debentures of Indian companies through Indian stock exchanges. Before investment, foreign investors need to register themselves in the country. The Government stipulates certain guidelines and eligibility conditions for registration. The Securities and Exchange Board of India announced the guidelines for registration. Table 1 given below shows the number of FII registered in India from 1992 onwards.

Table 1: Number of FII Registered in India

Financial Year	Total FII registered
1992-93	0
1993-94	3
1994-95	156
1995-96	353
1996-97	439
1997-98	496
1998-99	450
1999-00	506
2000-01	528
2001-02	490
2002-03	502
2003-04	540
2004-05	685
2005-06	882
2006-07	997
2007-08	1319
2008-09	1635
2009-10 (till July '09)	1679

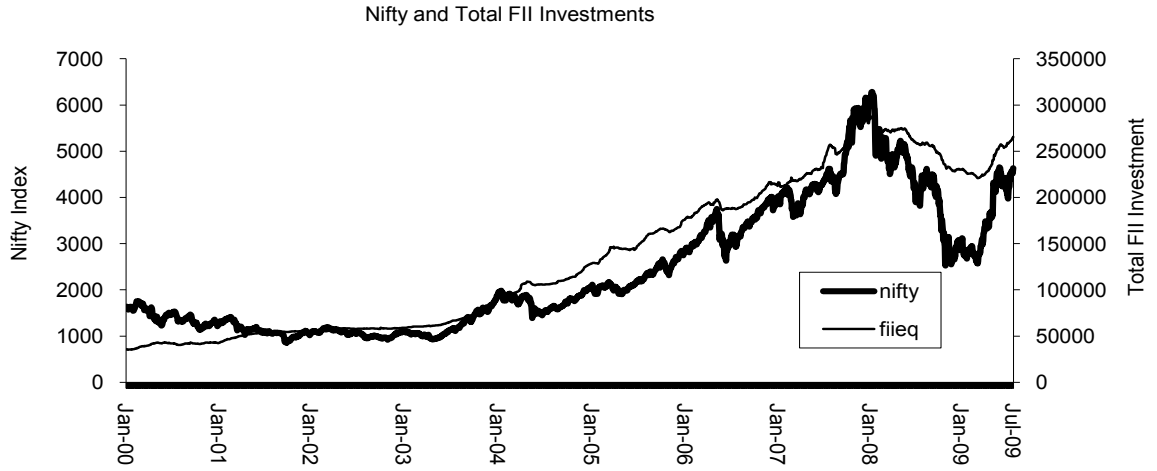
The table provides the number of foreign investors registered and allowed to invest in India according to Securities and Exchange Board guidelines. Number of FII registered in India has shown steady growth over the years. Data used in the table is available at the website of Securities and Exchange Board of India.

Investment through FIIs started flowing from January 1993. To increase and diversify the FII base, the government extended eligible categories of FIIs in the year 1996. They also gradually increased overall investment limits by FIIs, as also the types of instruments in which the FIIs can invest. Initially, FIIs could invest only in stocks, but from 1997 onwards, FIIs can invest in debt instruments having an upper limit of 30% of their investment. FIIs can also declare itself as a 100% debt FII. In March 1998, the Government accepted the L C Gupta Committee Report on Derivatives trading and allowed FIIs to buy and sell derivatives traded on stock exchanges. At the same time, the government simplified registration procedures and took steps to promote better exchange of information. It also allowed FIIs to invest in Commercial Paper from 2001.

The FIIs investing in Indian stock need to follow certain quantitative limits. The ceiling for overall investment for FIIs is 24 percent of the paid up capital of the Indian company and 10 percent for NRIs and PIOs. The limit is 20 percent of the paid up capital in public sector banks, including the State Bank of India. The ceiling for FII investment can further go up to a ceiling determined for each sector, subject to the approval of the board and the general body of the company passing a special resolution. In addition, the ceiling of 10 percent for NRIs and PIOs can increase to 24 percent subject to the approval of the general body of the company passing a resolution.

FII investment has steadily grown from $11,268 million in March 2000 to $62,464 million in July 2009. However, with the onset of global downturn in early 2008, the FII investment has started decreasing as FIIs began withdrawing from Indian markets. FII investment dwindled from the peak figure of Rs. 288,070 crore in 10th January 2008 (when Nifty stock index was 6,156.95) to Rs 220,931 crore in 13th March 2009 when Nifty index had fallen to a recent low of 2,719.25. With later upward correction of stock index, FII investments have started growing and at the end of July 2009, FII investment stood at Rs. 265,530 crore (at which time the Nifty index was 4,636.45). Figure-1 shows closing values of the Nifty Index and total FII investment for the period January 2000 to July 2009. The figures shows the relationship between flow of foreign funds and stock price movements. Table 2 presents year wise growth of FII capital flow in portfolio investment in India.

Figure-1: Nifty Index Movement and Total FII Investment in India



The figure shows total FII investment in India and movement of Nifty stock index from January 2000 to July 2009. The figures show association of flow of foreign funds and movement of stock prices. FII investment increased steadily until Jan 2008 but started declining when stock prices fell because of global meltdown in January 2008.

Table 2: Total FII Investment in India

Financial Year	Rs. crore	US ($) million
1999-00	39643	11268
2000-01	49849	13490
2001-02	57922	15186
2002-03	60449	15714
2003-04	100408	24465
2004-05	144529	34405
2005-06	193329	45404
2006-07	218565	50992
2007-08	271969	64235
2008-09	224263	53911
2009-10 (till July '09)	265784	62464

The table gives total foreign investment made in India after withdrawal of controls on foreign investments. One crore = 10 million. Data used in the table is available at the website of Securities and Exchange Board of India.

LITERATURE SURVEY

A few studies reported relations between FII investment and stock market responses in developing economies. Bohn and Tesar (1996) found that increase in US foreign investments and changes in the portfolio handled by US investors determine the consistency of investor behavior with the accepted models of international portfolio choice. By creating a model that uses data on foreign equity transactions and returns on investment, they find that buying behavior depends on more on investment opportunities in the developing world than the need to preserve balanced investments. Brennan and Cao (1997) developed a model of international equity portfolio investment flows based on differences in informational endowments between foreign and domestic investors. They found that domestic investors have an information advantage over foreign investors about their domestic market. Foreign investors buy foreign assets when the return on foreign assets is high and sell when the return is low. They tested implications of the model using data on US equity portfolio flows.

A few studies are also available in Indian context. Using a monthly data set for the period May 1993 to December 1999, Chakrabarti (2001) found that FII flows to India have steadily grown in importance since the beginning of liberalization. He analyzed these flows and their relations with other macroeconomic features and arrived at the following major conclusions. (1) While there may exist correlation between fund flows and stock returns in India, they are more likely to be the result than the cause of these returns. (2) FIIs are no at an informational disadvantage in India relative to local investors. (3) The Asian crisis marked a regime shift in the determinants of FII flows to India with the domestic stock returns becoming the sole driver of these flows since the crisis.

Mukherjee, Bose and Coondoo (2002) analyzed the relations of daily FII flows to the Indian stock market for the period January 1999 to May 2002. They explored the relations of foreign institutional investment (FII) flows to the Indian stock market with possible covariates. They identified some covariates of FII flows into and out of the Indian stock market. Their results showed followings. (1) Return in the domestic stock market influences FII flows to and from the Indian market and not the other way round. (2) Returns in the Indian stock market is an important (and perhaps the single most important) factor that influences FII flows into the country. (3) While FII sales and FII net investment influence Indian stock market movements, FII buying is not responsive to this market performance. (4) FII investors do not use the Indian stock market for diversification of their investment. (5) Return from exchange rate variation and fundamentals of the Indian economy may have influence on FII decisions, but such influences are not strong. (6) Daily FII flow shows autocorrelation but the covariates considered in the study do not explain this autocorrelation.

Gordon and Gupta (2003) found that both global and domestic reasons are important in deciding portfolio flows. They analyzed reasons that attract portfolio fund flows into India using monthly data. Flows to India are small in comparison with other developing markets, but show low volatility. The paper showed that both external and domestic reasons influence portfolio flows. Among external reasons, LIBOR and stock market returns are important, while the primary domestic determinants are the lagged stock return and changes in credit ratings. In quantitative terms, both external and domestic reasons are equally important. Suresh Babu and Prabheesh (2008) examined the relation between FII flows and stock market returns in Indian stock market. Using daily data from January 2003 to February 2007, they found the existence of bidirectional causality between FII flows and stock returns. They noted that domestic stock returns attract FII flows in line with the momentum-trading theory. Ray (2009) reported unidirectional causality between stock index and FII fund flow using daily data from January 2006 to June 2008. He found that domestic stock return attracts Foreign funds but FII fund flows do not cause stock returns in India.

METHODOLOGY

Data Source

This paper studies the impact of FII investment by using daily data for the period January 2000 to July 2009. We used the following three time series in this study. (1) Closing price of S&P CNX Nifty Stock Index (NIFTY) (2) Total FII Investment in stock markets (FIIEQ) and (3) Exchange change-over Rate in US$ to Indian Rupee (DOLLAR). The website of Securities and Exchange Board of India **(**www.sebi.gov.in/**)** makes available data related to total FII investment and exchange changeover Rate. The closing index value of S&P CNX Nifty for the period is obtainable from the website of National Stock Exchange of India (www.nseindia.co.in). This study resulted in analysis of 2,394 observations for the past nine and half years.

Causality Tests

Granger (1969) suggested a method for testing causality relations between stationary time series. To identify causal relations among FIIEQ, DOLLAR and NIFTY, we applied Granger causality test on daily dataset using Eviews software. Table 3 produces results of Granger Test.

Table 3: Pairwise Granger Causality Test Results

Null Hypothesis:	F-Statistic	Probability
FIIEQ does not Granger Cause DOLLAR	2.79558	0.06128*
DOLLAR does not Granger Cause FIIEQ	50.9822	0.00000***
NIFTY does not Granger Cause DOLLAR	57.5946	0.00000***
DOLLAR does not Granger Cause NIFTY	2.10528	0.12204
NIFTY does not Granger Cause FIIEQ	167.190	0.00000***
FIIEQ does not Granger Cause NIFTY	4.77149	0.00855***

*The table shows pairwise Granger Causality test results between Closing price of Nifty Stock Index (NIFTY), total FII Investment in stock markets (FIIEQ) and exchange change-over rate in US$ to Indian rupee (DOLLAR). The results show unidirectional causality between stock returns and exchange rate and bidirectional causality between other two pairs. Last column of the table provides t-statistic levels for rejection of null hypothesis. ***, **, * suggest significance at 1, 5 and 10 percent levels.*

From the test results, we can reject the hypothesis that FIIEQ does not Granger Cause DOLLAR at 10% level but we reject the hypothesis that DOLLAR does not Granger Cause FIIEQ at 1% level. Therefore, it appears that Granger causality runs bidirectional from DOLLAR to FIIEQ, but currency changeover rate strongly influences FII investments.

We also detected bidirectional causality between NIFTY and FIIEQ, which means rising stock price movements, attracts FIIs and simultaneously investment by FII influence stock prices in domestic markets. Most of the studies in Indian market reported unidirectional causality between market returns and foreign investments. They found domestic stock returns attract FII fund flows but FII flows do not cause stock returns in India. The results of this study using daily data for the past nine and half years however detected bidirectional causality. The tests confirm that FII investments influence both currency changeover rate and direction of movement of stock prices.

Testing for Unit Roots

It is a well-accepted fact that many financial time series contain a unit root, that is, the series are nonstationary and therefore, financial series used in the study might not be exceptions. Information related to stationarity of the time series is significant to indentify relations, as standard statistical techniques may not give correct inferences in the presence of stochastic trends. If the data is

nonstationary, ordinary least squares can produce spurious results. Therefore, before modeling any relations, we examine stationarity of the time series.

The Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests are two commonly used procedures in the empirical literature. In both the tests, the null hypothesis is that a unit root exists in the autoregressive representation of the time series. Table 4 given below tabulates the test results. Based on ADF and PP tests, we cannot reject the null hypothesis of a unit root at the level data for the selected series. The series were stationary at the first difference level. The results confirms order one I(1) integration in each of the chosen time series.

Table 4: Unit Root Test Results, p-value of ADF and PP tests

	Fisher ADF Test		PP Test	
Series	Levels	First Difference	Levels	First Difference
NIFTY	0.8882	0.0001***	0.9019	0.0001***
DOLLAR	0.6095	0.0001***	0.5538	0.0001***
FIIEQ	0.9746	0.0000***	0.9748	0.0001***

*The table provides test of stationarity on the time series using Fisher ADF test and Phillips-Perron test. ***, **, * suggest significance at 1, 5 and 10 percent levels. Though we rejected stationarity in the time series at their data, we found stationarity at their first differences*

Error Correction Model

Though ADF and PP tests determined that each time series are of order one, there may exist a special case in which a linear combination of the time series will show stationarity. Engle and Granger (1987) found that if two or more series integrated of the same order are themselves nonstationary but a linear combination of them becomes stationary, and then the series exhibits cointegration. The cointegrated time series can be used in regression equations without worrying about spurious relations.

An important idea closely linked to cointegration is, Error Correction Model (ECM). After identifying cointegration of two-time series X_t and Y_t, we can develop a matching ECM by the equation $\Delta Y_t = \beta_1 \Delta X_t + \beta_2 \left(Y_{t-1} - \gamma X_{t-1} \right) + \varepsilon_t$

When Y_t and X_t displays cointegration, $\left(Y_{t-1} - \gamma X_{t-1} \right)$ will be I(0) even though the constituents are I(1). $\left(Y_{t-1} - \gamma X_{t-1} \right)$ is the error correction term. To have an ECM, one first needs to know nature of cointegration among the selected time series. There are varieties of frameworks for testing the cointegration relations. Granger (1981) introduced the idea of cointegration. Engle and Granger (1987), Johansen (1988, 1995), and Johansen and Juselius (1990), among others developed the idea further.

Johansen's approach is more versatile than Engle and Granger's approach and therefore, we used Johansen's cointegration approach for modeling long-run equilibrium relations. This approach is available in many popular econometric software (for example GRETL, Eviews,). According to Eviews 6 User's Guide (2007), we can write a VAR of order p as follows.

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + B x_t + \varepsilon_t .$$

In the equation, y_t is a vector of I(1) time series, x_t is a vector of deterministic time series, and e_t is a vector of innovations. We can also rewrite the VAR described in above equation as follows.

$$\Delta y_t = \pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-1} + Bx_t + \varepsilon_t \text{, where: } \Pi = \sum_{i=1}^{p} A_i - I, \quad \Gamma_i = -\sum_{j=i+1}^{p} A_j$$

Estimates of Γ_i contain information on the short-run adjustments, while estimates of Π contain information on the long-run adjustments among the time series. Number of linearly independent columns in the Π matrix provides a measure for cointegration. Johansen (1988, 1995) developed a method to test the rank of Π and to find out value of other coefficients using a procedure known as reduced rank regression. Before the test using Johansen procedure, we need to decide certain related features like, lag length for the VAR and deterministic trend and intercept assumptions in the level data.

Lag of VECM Model

Estimating the VECM requires identifying a common lag length. In practice, we estimate the lag length using suitable information criteria. We used three different information criteria namely: Akaike Information criterion (AIC), Schwartz Bayesian criterion (BIC) and Hannan-Quinn criterion (HQC) to select best lag length. In this study, all three information criteria suggested lag of two days for the VAR model. We produce the respective AIC, BIC and HQC values in Table 5.

Table 5: Lag Lengths for VAR Model

Lag lengths	AIC	BIC	HQC
1	25.383386	25.412383	25.393937
2	25.087678*	25.138421*	25.106141*

To find out ideal lag length, we examined Akaike Information, Schwartz Bayesian and Hannan-Quinn values for various lag lengths. Selection of two days lag gives lowest value. Therefore, we have chosen the lag two days for following analysis.

Deterministic Trend Assumptions

According to Johansen's procedure, we need to select one of the following five deterministic trend assumptions.

1. The level data have no deterministic trends and the cointegrating equations do not have intercepts:
2. The level data have no deterministic trends and the cointegrating equations have intercepts:
3. The level data have linear trends but the cointegrating equations have only intercepts:
4. The level data and the cointegrating equations have linear trends:
5. The level data have quadratic trends and the cointegrating equations have linear trends.

There is little research available to help identify the most suitable deterministic trend assumption. Wesso (2000) suggested making the final decision by both macroeconomic theory and statistical evaluations. Eviews software provides a choice to summarize results in one table for all five choices. Table 6 provides numbers of cointegrating equations under each set of assumptions.

Table 6: Number of Cointegrating Relations by Model

	Option-1	Option-2	Option-3	Option-4	Option-5
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept	Intercept	Intercept	Intercept	Intercept
	No Trend	No Trend	No Trend	Trend	Trend
Trace	1	1	0	1	1
Max-Eig	1	1	0	1	1

Table lists number of cointegrating equations using Trace test and Maximum Eigenvalue test suggested by Johansen (1995) and based on critical values estimated by MacKinnon-Haug-Michelis (1999) at 0.05 levels against five deterministic trend assumptions. Majority of the choices suggest presence of one cointegrating relation among the chosen three series.

From the results given in Table 6, we have chosen the number of cointegrating relations for the selected series to be one. Except for option 3, all choices gave identical results of one cointegrating relation in both trace and Max-Eigenvalue tests.

Equations of Vector Error Correction Model

After identifying one cointegrating relation between the selected time series, we framed a Vector Error Correction Model (VECM). Eviews software was used to estimate the VECM model. Table 7 shows the error correction equations depicting relations of one series with current and lagged values of other series and its own lagged values.

Table 7: VECM Equations with Two Lags

Part A			
Cointegrating Equation	**CointEq1**		
NIFTY(-1)	1.0000		
DOLLAR(-1)	2.2984		
FIIEQ(-1)	-0.0137		
Part B			
Error Correction:	**D(NIFTY)**	**D(DOLLAR)**	**D(FIIEQ)**
CointEq1	-0.0004	0.0000	0.0509
D(NIFTY(-1))	0.0538	-0.0006	2.9817
D(NIFTY(-2))	-0.0314	0.0000	2.2015
D(DOLLAR(-1))	-16.3766	-0.0481	-199.4813
D(DOLLAR(-2))	-6.6468	-0.0117	-104.8602
D(FIIEQ(-1))	-0.0001	0.0000	0.1840
D(FIIEQ(-2))	0.0061	0.0000	0.1394

Part-A of the table gives cointegrating equation among the time series and Part-B shows error correction terms. The forecast for next period is available using an error correction equation. In the table the subscript (-n) stands for value of the variable at (n) period ago and D(Variable(-n)) shows one period change the variable value at (n) period ago. For further interpretations and resultant VECM equations, please refer E-Views 6 User's Guide. VECM equations explain change in value of one series with current and lagged values of other series and its own lagged values. For example, the following equation gives the expected change in NIFTY movement in the current period. D(NIFTY) = - 0.0004(NIFTY(-1) + 2.2983*DOLLAR(-1) - 0.0136*FIIEQ(-1)) + 0.0537*D(NIFTY(-1)) - 0.0313*D(NIFTY(-2)) - 16.3766*D(DOLLAR(-1)) - 6.6468*D(DOLLAR(-2)) - 0.0001*D(FIIEQ(-1)) + 0.0061*D(FIIEQ(-2))*

CONCLUSION

The objective of the study was to identify relations between FII investment in India with that of stock prices in the domestic market and domestic currency changeover rate. Using daily data for the period January 2000 to July 2009, the study examined cause-effect relations and long-term relations among the time series. Using Granger's pairwise causality tests, we detected bidirectional causality between exchange changeover rate and FII investment. This confirms FII investment depends on currency changeover rate. We also found bidirectional causality between NIFTY and FIIEQ. This means FII investment causes stock price movements and simultaneously direction of stock price movements influence FII investments.

Most of the studies in Indian markets reported unidirectional causality between market returns and foreign investments. According to these studies, domestic stock returns attract FII fund flows but FII flows do not cause stock returns in India. The results of this study using daily data for past nine and half years however detected bidirectional causality. Rising stock prices attract FII investment and simultaneously FII investments do influence stock prices in domestic market. Withdrawal of FII money can and do cause downward movement in stock prices. Finally, we designed a VECM model is using Johansen's

procedure depicting relations among Stock Index movement, FII Investment and currency change-over Rate.

We analyzed data in a single dataset covering nine and half years which includes periods of expansion and recession in the economy. Prevailing social, macroeconomic and political circumstances will also influence the relation among the series and leaves enough scope of further research in the area.

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BIOGRAPHY

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THE EFFECTS OF SHORT-TERM INTEREST RATES ON OUTPUT, PRICE AND EXCHANGE RATES: RECENT EVIDENCE FROM CHINA

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ABSTRACT

This paper utilizes VAR techniques to examine the relationship between a policy related variable and selected macro-variables in China. Johansen's cointegration tests fail to find a moving equilibrium among the related variables. Based on a VAR model in first differences, we find that an unexpected temporary one-off shock to the change in the seven-day money market interbank borrowing rate does not have significant influence on GDP changes but a significant influence on price level changes in a "wrong" direction. Empirical testing demonstrates that the seven-day Repo rate has an insignificant influence on both GDP changes and on the price level changes. Furthermore, the relationships between monetary aggregate (M2) and short-run money market interest rates suggest that the short-run interest rates do not have significant influence on the monetary aggregate. Therefore, we have determined that short-run money market interest rates are ineffective as a monetary policy-operating objective.

JEL: E4, E5, E6

KEYWORDS: monetary, money, macroeconomic policy

INTRODUCTION

Many studies have examined China's monetary policy mechanism, focusing on the effectiveness of intermediate targets, M1 and M2. For example, Xia and Liao (2001), Yu (2001), Xie (2004), and Geiger (2006, 2008) have argued that monetary aggregates (M1 and M2) are no longer suitable as intermediate targets, because the money multiplier is unstable and the monetary aggregates are not controllable by the nation's monetary authority. However, the optimal monetary policy target for China is debatable.

According Kasman (1992)，Morton and Wood (1993), Borio (1997, 2001), and Ho (2008), all central banks in the industrialised countries currently implement monetary policy through market-oriented instruments geared to influence closely short-term interest rates as operating targets. Ho's (2008) research on emerging Asian countries confirmed a number of broad themes across central banks with respect to the main features of policy implementation: focusing on short-term money market interest rates as operating objectives, favouring averaging reserve requirements, using interest rate corridors with penalty rates, and searching for alternative instruments. Therefore, the question of whether China's central bank should switch to short-term interest rate as its operating objective has attracted scholarly attention (see Xie and Luo, 2002; Yang, 2002; Xie and Yuan, 2003; Lu and Zhong, 2003; Wang and Zou, 2006; Wu, 2008). In regards to monetary theory, the precondition for adopting short-term interest rate as an operating instrument is that an effective an interest rate transmission mechanism established in a specific monetary framework and the operating objectives closely correlated to the final policy goal. However, whether short-run interest rates are highly correlated with China's monetary policy goals – price stability and economic growth – remains ambiguous.

This study uses Vector AutoRegressive (VAR) techniques to analyse the monetary transmission mechanism in China. Specifically, the study seeks to answer two questions:

1. How does a monetary policy shock, defined as a temporary and exogenous change in the short-term money market interest rate, affect real output, prices, and the nominal effective exchange rate?
2. How much do variations in short-run interest rates account for fluctuations in output, price level, and the nominal effective exchange rate?

The remainder of this paper is organized as follows. The next section describes the introduction of the study followed by background information on China's monetary framework and the literature review on monetary policy instruments. The data and research methodology present the empirical models and variables used in the study. The empirical results section discusses the relationship between the monetary policy variables and both output and prices in China using a VAR analysis. The last section concludes the paper.

BACKGROUND INFORMATION

The People's Bank of China (PBC) states that the aim of monetary policies is to maintain stability in the value of the currency and thereby promote economic growth. Therefore, the central bank is committed to two objectives: realizing price stability and promoting economic growth. The PBC claims to pursue currency stability as the sole target of its monetary policy, but it is impossible to ignore the goal of economic growth given its decision process is not independent of the state council's directives.

Since exchange rate unification in 1994, China has maintained a manageable floating exchange rate regime, a de facto peg of the renminbi (RMB) to the US dollar (USD), with different floating bandwidths during different periods. A crawling peg regime from 1994 to 1996 followed a de facto peg of the RMB against the USD with a trading band of 0.4 per cent (about RMB/USD 8.28). The trading band tightened to 0.01 per cent around the parity of RMB/USD 8.277. After an immediate appreciation of the RMB against the USD of around 2 per cent on July 21, 2005, China's exchange rate regime changed a peg against a basket of currencies, with a fluctuation bandwidth up to 0.3 per cent of the previous day's exchange rate (Anderson, 2005). On May 21, 2006, the daily floating band of the RMB against the USD trading price expanded to 0.5 percent (People's Bank of China, 2007). Based on this account, one can conclude that another objective of China's monetary policy is to maintain the stability of exchange rate vis-a-vis the USD.

Concerns on the risks of financial sector reform have led to a gradual interest rates liberalization that took place relatively late in the course of economic reform. The liberalization of the interest rates were announced in November 1993 at the Third Plenum of the Fourteenth Communist Party Central Committee (CPCC). The Party recognized that the central bank should promptly adjust the benchmark interest rates according to changes in market supply and demand. This allows the commercial banks to set their loans and deposits rates within a specific range. In 2002, the Sixteenth National Congress reiterated the need to advance interest rates reforms and optimize financial resource allocation. Furthermore, the Third Plenary Session of the Sixteenth Central Committee in 2003 argued the need to establish a robust mechanism for market-based interest rates and monetary policy actions consistent with the country's economic objectives (Bernard and Maino, 2007).

During the period 1986-1993, China's policies included targets on currency in circulation and bank's loans portfolios. In September 1994, the PBC defined and announced three levels of money supply indicators; M0, M1, and M2. In 1996, the PBC formally treated money supply as an intermediate target.

The elimination of credit ceilings in 1998 left M2 (money supply) as the single major intermediate target. The theoretical assumptions underlying China's monetary policy is that the objectives such as the GDP growth rate and the inflation rate correlate with the intermediate targets (money supply), that the intermediate targets are firmly connected to the monetary base. Equivalently, the money multiplier is assumed to be stable, and the central bank can influence intermediate targets by adjusting policy instruments.

LITERATURE REVIEW

Several scholars had devised classification schemes to describe the mechanism central banks have at their disposal for controlling financial activities.

Bernard (2004) has noted that monetary policy instruments fall into two broad categories: rules-based instruments and monetary market operations. The first category refers to the regulatory power of the central bank, which includes liquidity asset ratio, reserve requirements, and standing facility. The second category, market operations, is used at the discretion of the central bank. These bear an interest rate linked to money market conditions and aim to influence the underlying demand and supply conditions of the central bank. This includes open market–type operations, auction techniques, and fine–tuning operations (Bernard, 2004).

Xie (2004) classified the PBC's 13 monetary policy instruments into four categories relevant to 1983-2002: (1) instruments with ratios such as required reserve ratios; (2) interest rates, such rediscount rates, central bank interest rates on reserve requirements, central bank lending rates, deposits and lending interest rates of financial institutions; (3) quantity instruments, such as central bank lending, open market operations (on treasury bonds and foreign exchange), rediscounting; and (4) other instruments, such as central bank bills, central bank bonds, special deposits to the central bank, standing facilities, and moral suasion.

Geiger's (2006, 2008) classification of the PBC's monetary policy instruments is different from Xie's classification. He identifies two main categories of PBC's instruments, price-based and quantity-based. Price-based instruments are indirect and incorporate PBC lending and deposit rates, discount and rediscount rate, reserve requirements, and open market operations (OMOs). Quantity based instruments are direct and include window guidance, direct PBC lending, and capital control.

Bernard and Maino (2007) summarized China's main monetary policy instruments as standing facilities, OMOs, reserve requirements, interest rates control, window guidance, and other administrative measures. "The PBC has developed a set of monetary instruments which conform to best practices and which place the PBC in a relatively strong position to rely primarily on market-based instruments in the conduct of money policy. Open market operations in the form of issuance of PBC bills play an important role in the sterilization of excess liquidity and reserve requirements provide important support to OMOs" (Bernard and Maino, 2007, pp. 14).

Based on Bernard's (2004) theoretical framework, we can conclude that the current choice of China's monetary policy is a mix of rules-based instruments and money market operations. In 1993, the PBC introduced the OMO into its monetary policy toolbox. Following the abolishment of the credit rationing policy in 1998, the OMOs became the PBC's main monetary policy instrument. The PBC benchmark lending rates - rediscount rates, the interest rate on required reserves, and excess reserves constitute an upper and a lower limit in the money market interest rates. The central bank bill rates serves as a target rate in setting the money market interest rate, such as the federal fund rate in the U.S (Xie, 2004; Wu, 2008). Automatic collateralized lending and the excess reserves facility constitute China's standing tools for monetary control.

Xie (2004) investigated the relationship between the monetary aggregate (M1, M2) and the monetary base, from the first quarter of 1994 through the fourth quarter of 2002. The results of the quarterly cross-correlation coefficients and Granger-causality tests for the base money and monetary aggregates indicate that the impact of the monetary base on M1 is not strong, and the impact of the monetary base on M2 is even weaker. Among the four different liquidity injecting channels, namely, the PBC's lending to financial institutions, foreign exchange purchase by the monetary authority, OMOs on treasury bonds, and the rediscount window, only the central bank lending Granger causes M1, and none Granger causes M2. Therefore, monetary aggregates are endogenously determined and have strong correlations with monetary policy.

Xie (2004) also explored the dynamic relationships between monetary aggregates, economic growth, and inflation rates using data from the first quarter of 1992 to the third quarter of 2002. The author argues that the money supply affects output and money is not neutral in the short run. Nevertheless, the impacts of money supply on output last no more than eleven quarters. Money is neutral in long run and the impacts of money supply on output are not of a permanent nature. In both the short run and long run, money supply and inflation correlate, where changes in the money supply have permanent effects on the inflation rate and the price level. Geiger (2006, 2008) documents severe deviations of the targeted and the actual values from 1994-2004 and 1994-2006.

Table 1 compares the targeted with the actual values of China's monetary aggregates, M1 and M2 from 1994 to 2006. The targeted and the actual values fell only three times in the case of M1, and four times in the case of M2. Strong deviations of more than four percentage points occurred several times for both M1 and M2, and this raises the doubt on the controllability of the monetary aggregates.

Table 1: Targeted and Actual Values of PBC Monetary Aggregates (1994-2006)

Year	M1 growth (per cent)		M2 growth (per cent)	
	Target	Actual	Target	Actual
1994	21	26.2	24	34.5
1995	21-23	16.8	23-25	29.5
1996	18	18.9	25	25.3
1997	18	16.5	23	17.3
1998	17	11.9	16-18	15.3
1999	14	17.7	14-15	14.7
2000	15-17	16	14-15	14.7
2001	13-14	12.7	15-16	14.4
2002	13	16.8	13	16.8
2003	16	18.7	16	19.6
2004	17	13.6	17	14.6
2005	15	11.8	15	17.6
2006	14	17.5	14	16.9

This table shows the comparison of the targeted and the actual values of the China's monetary aggregates of the M1 and M2 from 1994 to 2006 (Geiger, 2008).

The systematic liberalization of the interest rates involved the lifting of the restrictions on wholesale transactions followed by liberalization of the retail transactions. Interest rates on foreign currencies deposits and lending were eliminated before those for local currency (Bernard and Maino, 2007). The reform on market interest rates progressed steadily from 1996. By the end of 1999, the interbank borrowing rates, discount rates for commercial paper, and repos and spot trading rates in the interbank bond market were fully liberalized. The purchasers' bids determined the interest rates on policy financial

bonds and treasury bonds (Xie, 2004). The PBC also adjusted the refinancing rate to a reference rate for the money market.

Reform of the retail banking operations involved first allowing banks to price counterpart risks on customers within a floating margin before fully liberalizing the lending and deposit rates (Mehan, Quintyn, Nordman, and Laurens, 1996). The authorities reduced the number of administered interest rates, adjusted bank lending rates on industrial and commercial enterprises more frequently to reflect changes in the PBC benchmark rate, and allowed financial institutions to price their lending operations within a floating margin. The discretionary bands on lending rates expanded in 1998(Xie, 2004). In October 2004, the PBC removed ceilings on lending rates and floors on deposit rates. A floor for lending rates and a ceiling for deposit rates protect the banks' intermediation margins. The PBC reduced about 120 administered interest rates from 1996 to 2007 (Wu, 2008).

Both the depth and breadth of the money markets in China have improved significantly over the past decade. Currently, China's money market comprises of three sub-markets. The first sub-market is the interbank money market. Originating in the 1980s and modified in 1993, a reformed and unified national interbank market started operation in January 1996, where banks lent and borrowed funds among themselves for terms from overnight to four months. The amount of lending and borrowing are fixed in proportion to the balance of deposits. In contrast, non-bank financial institutions lend and borrow funds among themselves for a maximum of seven-days and the trading volumes depend on the capital level. The seven-day loan rate is the China's inter bank offered rate (CHIBOR) (Xie, 2002).

By the end of 2007, the number of market participants reached 717, fourteen times greater than when markets began operation. As of November 28, the trading volume reached RMB13,700 billion. The interbank markets rules and regulations were enforced in August 2007. Stephen (2007a, 2007b) argues that the introduction of a more market driven reference rates such as the Shanghai interbank offered rate (SHIBOR) for the onshore money market is a critical step in terms in improving China's money market.

The second sub-market is the interbank bond market, which functions as a liquidity market. The China inter-bank bond market began operation in June 1997. By the end of 2007, the number of participants was 7095 (The People's Bank of China Annual Report, 2007). Both the turnover and the liquidity of the interbank bond market have expanded significantly, with a total turnover exceeding RMB100,000 billion in 2008. The tradable stocks increased from RMB72.3 billion in 1997 to RMB9,024 billion by June 2008 (China Monetary Policy Report, 2008). It is currently the biggest bond market in China.

China's interbank bond market currently has three characteristics added since its initial development. First, the trading participants in the interbank bond market is diversified by allowing non-banking financial institutions (such as funds companies, securities companies, and insurance companies) and other enterprises to trade in this market. Second, with Treasury bonds and PBC bills as the main trading products, the debts issued by policy banks and commercial banks, and commercial papers issued by the financial companies and other big corporations have increased significantly. Issuers of bonds in this market have included the Ministry of Finance, the central bank, policy banks, commercial banks, nonbanking financial institutions, and corporations. The central bank uses the term structure of bond yields and long-term interbank rates as reference rates to predict inflation trends. This also serves as an important basis for pricing other financial products through the market.

Finally, the bond repo market, the third sub-market of the money market, is used for short-term borrowing. Turnover reached RMB51,580 billion by the end of November 2008. Since 1997, the repo rate has been set by the market, with the most active contracts between one and seven days. The seven-day repo in effect became the bond benchmark rate and it became the official reference indicator for the money market from October 12, 2004. Because commercial banks, securities companies, and other financial

institutions trade in this market, frequent changes in the repo rate reflect changes in the stock and money loans markets (ChinaNet). This market is less volatile and liquid than the CHIBOR and its successor SHIBOR. Compared with interbank markets, repo markets are more active and the interest rates are more stable (Xie, 2002; Loretan and Wooldridge, 2008).

The segmentation in the money markets is the result of regulations, because the initial operations of the money markets led to disorder in the financial industry in the early 1990s. Instead of using it as a means to manage reserves by commercial banks, it is abused by both financial and other nonfinancial institutions to obtain short-term funds to invest in securities and real estate (Xie, 2002; Bernard and Maino, 2007). In order to prevent bank funds being used to participate in the stock market, the PBC ruled that commercial banks would withdraw from repo trading on the stock exchange. Beginning in 1997, commercial banks were only allowed to carry out repo trading on the interbank market, with the goal of building a firewall between the money and capital markets (Xie, 2002; Bernard and Maino, 2007). Short-term borrowing by securities companies in the interbank market led to contagion, as changing conditions in the capital market had a direct impact on the interbank markets. From 2000, securities companies, funds management companies, and other non-banking financial institutions were permitted to trade into the inter-bank markets under certain conditions. However, the coexistence of the interbank bond market and the stock exchange bond market, and the limits on RMB interbank market activity for commercial banks funded in foreign currencies remain the source of market segmentation (Wu, 2005; Bernard and Maino, 2007).

In 1994, China adopted a managed floating exchange rate regime against the USD, coupled with a move to partial convertibility on the current account (Zhang, 2001). Further, in December 1996, China adopted current account convertibility, but maintained administrative controls on the capital account (Xie, 2004). Following the 1997 Asian financial crisis, China implemented a fixed foreign exchange regime. This was in place until July 2005, when they announced a switch to a new exchange rate regime. The exchange rate would be set with reference to a basket of other currencies, with numerical weights unannounced. This allowed movement within any given day towards increased flexibility (Frankle, 2009). However, some researchers argued that China's current foreign exchange policy was still "fixed" instead of "floating" (see McKinnon and Schnabl, 2006; Frankle and Wei, 2007; Prasad, 2007).

Previous studies argue that for one country unfettered movement of international capital, independent monetary policy and a fixed exchange rate policy cannot coexist. In theory, capital controls can prevent large inflows (outflows) when domestic interest rates are higher (lower) than foreign rates. This allows the PBC to operate an independent monetary policy. In practice it is difficult to maintain effective capital controls over time, particularly in an economy like China's, that is not only open to trade but trades extensively (Goldstein and Lardy, 2007; Wu, 2006). With a large current account surpluses, the PBC faces the challenge of sterilizing the increase in the domestic money supply resulting from the large purchase of foreign exchange (i.e. sale of domestic currency).

China's balance of payments has remained strong since 1996, and its global current account surplus has expanded substantially over recent years. The current account surplus was $72.4 billion in 1996, rising to $68.7 billion (3.6 percent of GDP) in 2004, $160.8 billion (7.2 precent of GDP) in 2005, and $371.8 billion in 2007 (11.3 precent of GDP) (National Bureau of Statistics, 2008; IMF Statistic Database, 2007; State Administration of Foreign Exchange). Since then, China's account surplus (in absolute terms) is the largest of any country.

The build-up of official holding of foreign exchange reserves has accelerated since 2005. In the 12 months from June 2005 to June 2006, the foreign exchange reserves rose by $240 billion and $230 billion, respectively (Goldstein and Lardy, 2007). However, in the 12 months through June 2007, foreign exchange reserves rose by $391 million, about three-fifths more than in the previous two 12 month

periods, In the 12 months through June 2008, the foreign exchange reserves rose by an astonishing $467 billion. At the end of September 2008, total foreign exchange reserves reached $1,905.5 billion (People's Bank of China, 2008).

Since the unification of China's exchange rate in 1994, the RMB has been under pressure to appreciate, except during the 1997 Asian financial crisis year. To maintain stability in the RMB, the PBC adopted several comprehensive measures. These have included improving the foreign exchange purchase-and-sale system via foreign exchange designed banks, changing interest rate policy and shifting to OMOs (Xie, 2004). Following 2000, the appreciation pressure was fueled by expanding capital inflows and foreign trade surpluses. Thus, the PBC has more pressure to intervene in the market.

Anderson (2004, 2005) and Stephen (2007a, 2007b) suggest that China can run an independent monetary policy under any foreign exchange regime and have little difficulty in retaining control of the growth of its domestic money supply. They argue that this can be absorbed with relatively effective capital control and successful stabilization via the sale of central bank bills and an increase in the required reserve ratio for banks. In contrast, Goldstein and Lardy (2006), Lardy (2006), and Prasad, Rumbaugh, Wang (2005) argue that China's (quasi) fixed exchange rate has weakened the effectiveness of its monetary policy. They believe that the resulting policy mix has left China with an interest rate structure that is far from optimum. Since a low real interest rate contributes to an underlying excess demand for credit and rapid growth of lending from banks, low deposit interest rates have been a major contributing factor to the boom in the property market.

DATA AND METHODOLOGY

This section examines the relationship between the monetary policy variables and both output and prices in China using VAR analysis. Since Sims's seminal paper in 1980, the VAR framework has been widely used in macroeconomics research as it allows the direct estimation of the joint stochastic process describing the variables under consideration. If one is unclear on which variable is endogenous and which is exogenous, the VAR method allows the researcher to treat all variables as jointly endogenous. Researchers using VAR to identify transmission of monetary policy in advanced economies include Christiano, Eichenbaum, and Evans (2000) for the United States, Kim and Nouriel, (2000) for the G-7 economies, and Peersman and Smets (2003) for the Euro area. Armenia by Era and Holger (2007) and Kenya by Cheng (2006) use the VAR framework to study the monetary policy transmission mechanism in developing countries. In this study, we use quarterly data from 1996:Q1 to 2008:Q1 to examine the macroeconomic dynamics of the unified interbank market operation in China. We first test all time series for unit roots using the augmented Dickey-Fuller method, and then estimate a reduced form VAR, indentifying money policy shocks through the assumptions about variable ordering.

Data and Variable Description

First, we consider the effects of short-term interest rates on GDP, general price level, monetary aggregate, and exchange rates. We assume the 7-day interbank money market rate (INTm), and the CHIBOR market's benchmark, as the PBC's policy stance (i.e., a 7-day repo rate (INTr), which is another benchmark short-term interest rates used in the interbank bond market). Another policy-related variable in our study is the domestic monetary aggregate M2 (M), which is the intermediate target of the PBC. We use the nominal effective exchange rate (NEER) to examine effects on output and prices. The output measure is real GDP with the consumer price index (CPI) as the general price level. All data are expressed in natural logs and are seasonally adjusted using ARIMAX12, with the exception of short-term interest rates. Table 2 display the unit root tests for the time series. The unit root tests show that INTm and INTr are trend stationary variables.

Table 2: Unit Root Tests for Time Series

Variable	(C,T,K)	ADF-Statistic	1% critical value	5% Critical Value	P-Value
GDP	(C,0,1)	0.590	-3,563	-2.921	0.98
CPI	(C.0.0)	2.581	-3.5654	-2.919	1.00
M	(C,0,0)	-0.712	-3.565	-2.919	0.83
INTm	(C,0.0)	-3.962	-3.563***	-2.919	0.00
INTm	(C,T,0)	-1.709	-4.148	-3.500	0.73
INTr	(C,0.3)	-3.024	-3.605	-2.936**	0.04
INTr	(C,T,3)	-2.908	-4.205	-3.526	0.17
NEER	(C,0,1)	-0.474	-3.568	-2.921	0.88

*This table reports the unit root tests results. (C,T,K) indicates constant, trend, and lag-length included in the unit root test. The unit root tests show that INTm and INTr are trend stationary variables. *** and ** stand for the significance at 1 and 5 percent respectively.*

The variables in the model should be stationary in displaying the relationships among the output, prices, and policy-related variables in a VAR. However, the unit root tests show the instability of the time series used in our study. Sims (1980) and Sims, Stock and Watson (1990) recommend against differencing when the related variables are cointegrated, even if the variables contain a unit root. They argue that the goal of a VAR analysis is to determine the interrelationships among the variables, not to determine the parameter estimates. Conducting the analysis in levels allow for implicit cointegration relationship in the data. However, if the related $I(1)$ variables are not cointegrated, it is preferable to use the first difference. There are three consequences if the $I(1)$ variables are not cointegrated and one estimates the VAR in level. The first consequence is the test loses its power because we estimate n^2 with more than one parameter. The second is the test for Granger causality on the $I(1)$ variables, which do not have a standard F distribution for a VAR in levels. The last is when the VAR has $I(1)$ variables, the impulse responses at long forecast horizons are inconsistent estimates of the true response.

Enders (2004) notes that the lag length test can be performed regardless of the variables in question are stationary or integrated. Eviews 6 selects the lag length of the VAR model using the VAR lag order selection criteria. All the information criteria select a lag order of one. The residual test suggests that we can reject autocorrelation and heteroskedasticity at the conventional 5% significance level. Based on the selected lag length, we perform two cointegration tests: one for the same five variables in the level VAR, and exclude the short-term interest rates in the second test. The results show that when short-term interest rates are included into the VAR, we fail to reject the null hypothesis of no cointegration (see table 3).

Table 3: Johansen Cointegration Test Results

Variables: GDP, CPI, M, INTm, NERR (p=1)				
H_0	Trace	5% Critical Value	Max-Eigen	5% Critical Value
$r = 0$	76.72	88.03	27.07	38.33
Variable: GDP, CPI, M, NEER (p=1)				
H_0	Trace	5% Critical Value	Max-Eigen	5% Critical Value
$r = o$	67.50	54.07	35.99	28.58

This table reports two Johansen Cointegration test results, one for the five variables in the level VAR, excluding the short-term interest rate variable.

In this study, we use the first order difference of the related variables to construct a VAR model. The basic concepts underlying the VAR modelling process can be summarised as follows.

Let Y_t be a $n \times 1$ vector of variables, ε_t a $n \times 1$ vector of mean zero structural innovations and $B(L) = B_0 - B_1 L - B_2 L^2 - \ldots B_p L^p$ a $n \times n$ matrix polynomial in the lag operator. The pth order structural VAR model is written as:

$$B(L) = \varepsilon_t \; ; \; E\varepsilon_t \varepsilon_t^{'} = \Lambda \; ; \; E\varepsilon_t \varepsilon_{t+s}^{'} = 0 \; , \quad \forall \neq 0 \tag{1}$$

where Λ is a diagonal matrix. B_0 is a non-singular normalized matrix with ones on the diagonal. This matrix summarizes the contemporaneous relationships between the variables of the model. Since the coefficients are the unknown and the variables have contemporaneous effects, we therefore transform equation (1) into a reduced form VAR:

$$Y_t = A(L)Y_t + \mu_t \; ; \; E\mu_t \mu_t^{'} = \sum \; ; \; E\mu_t \mu_{t+s}^{'} = 0 \; , \forall \neq 0 \tag{2}$$

where $A(L) = B_0^{-1} B(L) = I - AL - A_2 L^2 - \ldots A_p L^p$ and $\mu_t = B_0^{-1} \varepsilon_t$.

The error terms μ_t are composites of the underlying shocks ε_t. The model must be exactly or over-identified in order to estimate the structural model. In order to recover the structural parameters from the reduced form model, there must be the same number of parameters in B_0 and Λ as there are in Σ, the covariance matrix of the reduced form. Hamilton (1994) called this the order condition.

Combining equation 1 and 2, the variance-covariance matrix, Σ can be expressed as follows:

$$\Sigma = (B_0^{-1}) \Lambda (B_0^{-1})^{'} \tag{3}$$

Consistent estimates of F ($F = B_0$) and Λ can be obtained through the sample estimation of Σ, which can be obtained by maximum likelihood estimation. The right hand side of equation (3) contains $n \times (n+1)$ parameters to be estimated, while the left-hand side contains only $n \times (n+1)/2$ parameters; we need $n \times (n+1)/2$ restrictions to achieve identification. If the n diagonal elements of Λ are set to one, all that is required is a further $n \times (n+1)/2$ restrictions on B. There are only a few methods to recover the parameters of the structural form from the parameters in the reduced form. The most widely used approach in recursive VAR models is the Cholesky decomposition (Don and O'Reilly, 2004; Cheng, 2006).

The vector of endogenous variables in our benchmark model, equation (4), consists of real GDP (GDP), the consumer price index (CPI), monetary aggregate (M), interbank market borrowing rate (INTm), and nominal effective foreign exchange rate (NEER). We replaced interbank market bond repurchase rate (INTr) with INTm in equation (5) to test the robustness of our results.

$$Y_t = [GDP, CPI, M, INTm, NEER] \tag{4}$$

$$Y_t = [GDP, CPI, M, INTr, NEER] \tag{5}$$

Equation (4) shows the ordering of the variables. Intuitively, we assumed that prices (CPI) have no immediate effects on output (GDP), money stock (M) has no immediate effect on prices, monetary policy shock (INTm) has no immediate effect on the money stock, and the nominal effective exchange rate (NEER) has no immediate effect on the money policy. Technically, this amounts to first estimating the reduced form of the benchmark model equation (4), then computing the Cholesky factorization of the

reduced form VAR covariance matrix. In other words, the relations between the reduced form errors and the structural disturbances are given as follows:

$$\begin{bmatrix} \varepsilon_t^{GDP} \\ \varepsilon_t^{CPI} \\ \varepsilon_t^{M} \\ \varepsilon_t^{INTm} \\ \varepsilon_t^{NEER} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ f_{21} & 1 & 0 & 0 & 0 \\ f_{31} & f_{32} & 1 & 0 & 0 \\ f_{41} & f_{42} & f_{43} & 1 & 0 \\ f_{51} & f_{52} & f_{53} & f_{54} & 1 \end{bmatrix} \begin{bmatrix} \mu_t^{GDP} \\ \mu_t^{CPI} \\ \mu_t^{M} \\ \mu_t^{INTm} \\ \mu_t^{NEER} \end{bmatrix} \quad (6)$$

The standard practice in VAR analysis is to report results from Granger-causality tests, impulse responses, and forecast error variance decompositions (Stock and Watson, 2001). Because of the complicated dynamics in the VAR, these statistics are more informative than are the estimated VAR regression coefficients or R^2 statistics, which typically go unreported (Stock and Watson, 2001). Granger-causality statistics examine whether the lagged values of one variable help to predict another variable. Table 4 summarizes the Granger-Causality results for the five-variable VAR and shows the P-values associated with the F-statistics for testing whether the relevant sets of coefficients are zero.

Table 4: VAR Granger-Causality/Block Exogeneity Wald Tests

	Dependent Variable in Regression				
Regressor	ΔGDP	ΔCPI	ΔM2	ΔINTm	ΔNEER
ΔGDP		0.56	0.74	0.20	0.86
ΔCPI	0.45		0.51	0.29	0.37
ΔM	0.21	0.95		0.07*	0.55
ΔINTm	0.61	0.06*	0.90		0.49
ΔNEER	0.84	0.01**	0.86	0.71	

*This table summarizes the Granger-Causality results for the five-variable VAR. * and ** indicates significance level of 10 and 1 percent levels respectively.*

The result shows increases in the growth rate of INTm and NEER were significant to predict the CPI growth rate at 10% and 1% significance levels respectively, but did not Granger-cause GDP. An increase in the growth rate of the monetary aggregate Granger-causes the growth rate of INTm at the 10% significance level, but not vice versa.

RESULTS

Impulse responses trace out the response of current and future values for each of the variables to a one-unit increase in the current value of one of the VAR errors. This assumes that errors return to zero in subsequent periods and that all other errors are equal to zero (Stock and Watson, 2001). In other words, the interpretation of the impulse response requires that the innovations be contemporaneously uncorrelated across equations. However, the innovations in a VAR are correlated and may be viewed as having a common component, which cannot be associated with a specific variable (Eviews 6). Thus, we use the inverse of the Cholesky factor of the residual covariance matrix to orthogonalize the impulses.

Figure 1 presents the impulse response functions, showing the impact of a one-off rise in the INTm growth rate on output, prices, monetary aggregate and exchange rate. The dotted lines represent the 95% confidence levels and the impact of a unit rise in the growth rate of monetary aggregate on other variables. Output growth rate changes by about 0.4%, peaking at the second quarter and vanishing completely at the

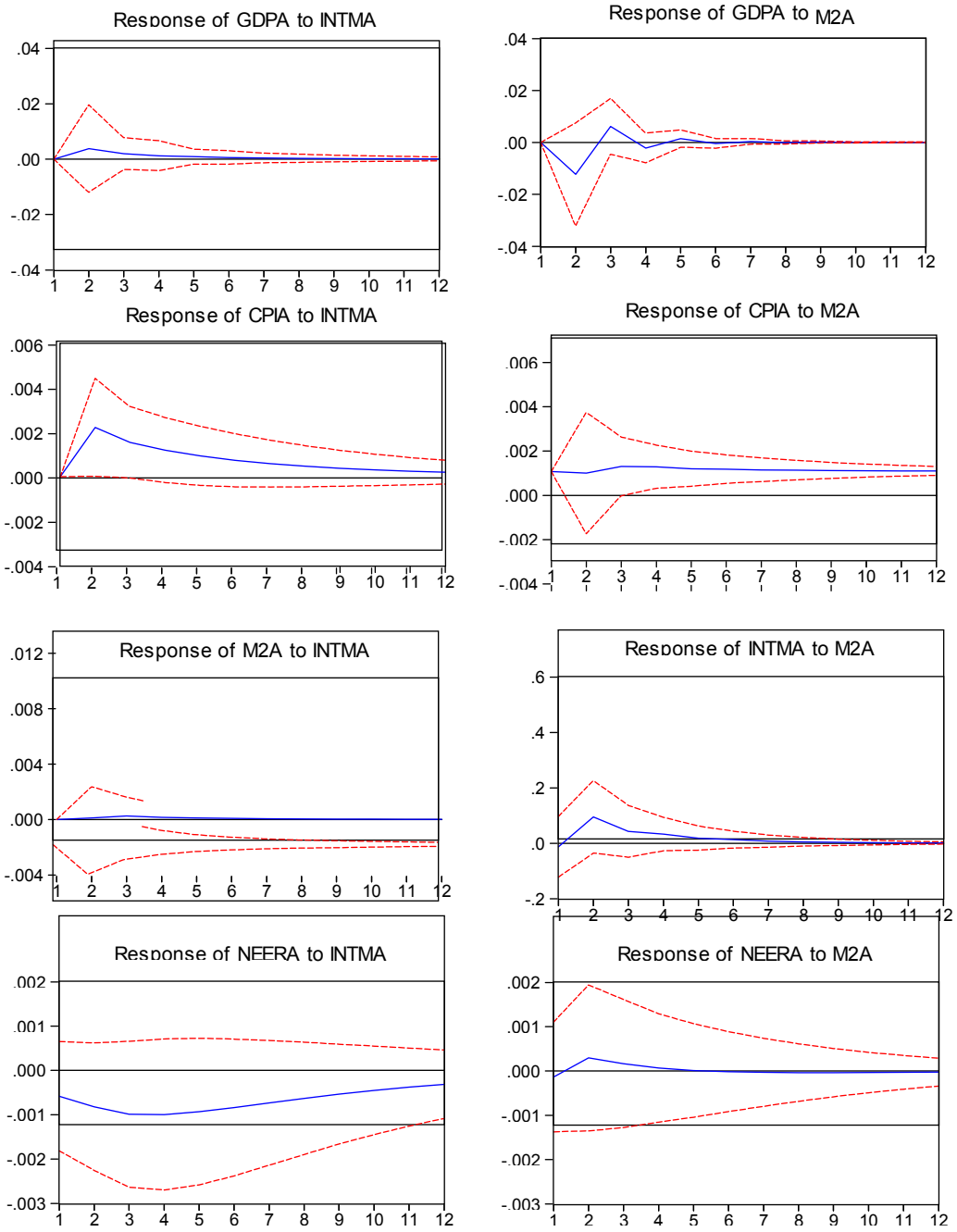
seventh quarter following the monetary contraction. The CPI growth rate changes by about 0.2%, peaking at the second quarter and decreasing to below 0.1% at the fifth quarter after contraction. The response of the monetary aggregate growth rate to the interest rate growth shock appears to be insignificant. However, an inspection of these impulse response functions shows that the response functions of GDP growth rate and CPI growth rate are inconsistent with what we expected to be the effects of a contraction in monetary policy. Only the impulse response function of the nominal effective exchange rate appeared to be consistent with the theoretical prediction that an increase in the interest rate growth rate leads to an appreciation of the nominal exchange rate, but is statistically insignificant.

Furthermore, we examine the impacts of the shocks of monetary aggregate growth rate on the other variables. A rise in a one-unit monetary aggregate growth rate results in a 1% decline in GDP growth rate, reaching the trough at the second quarter and reverting to 0.5% at the peak of third quarter. An increase in monetary aggregate leads to a decline in real GDP within two quarters, and then promotes economic growth with four to six quarters' lag. There is an insignificant impact on both the CPI and NEER growth rates. However, the impact on the short-term interest rate is significant at the 10% level after one quarter.

The forecast error decomposition is the percentage of the variance of the error made in forecasting a variable due to a specific shock at a given horizon (Stock and Watson, 2001). The relative importance of monetary policy fluctuations in the other variables can be measured through variance decomposition. Table 5 reports the variance decomposition of the five VAR, variables covering 1 to 12 quarters. The second column in each sub-table shows the forecast errors of the variable for each forecast horizon. The remaining columns present the percentage of the variance due to the shock of the variable appearing as the column heading, with each row adding up to 100. The results show that innovations in INTm growth rate account for about 0.34 percent of the forecast error variance in the output growth rate and about 9 percent in the price level growth rate in a year. Innovations in the monetary aggregate growth rate explain about 3.24 percent of the output growth rate forecast error, and only about 0.1 percent in the price level growth rate. The innovations of money supply growth rate and interest growth rate explain each other, at about 4.7 and 0.1 precent respectively. Our results confirm the insignificant influence of changes in short-run interbank bank borrowing interest rate on GDP growth rate, and the statistically significantly influence on price level growth rate, but in the "wrong" direction. This further confirms that monetary aggregate growth rates have no influence on both the GDP and price level fluctuations. Another interesting result is that shocks to the monetary aggregate growth rate, which significantly influence the INTm change rate rather than the reverse.

Figure 2 displays the impulse responses to monetary policy shocks defined as temporary, unexpected and exogenous rises in Repo growth rate, with the variance decomposition of the forecast errors shown in Table 6. The results support our conclusion. For a one-unit rise in Repo growth rate, the GDP growth rate rises by about 0.4% at the second quarter peak and decreased to 0.08% in the fourth quarter; the CPI growth rate rose at the peak by 0.2% in the second quarter. The directions of the changes are similar to those in the benchmark VAR. Within one year, the innovations in the Repo growth rate explained about 0.35 percent of the GDP growth rate forecast error and about 7.7 percent for the price level growth rate forecast error. However, the impact of the Repo and monetary aggregate on GDP is statistically insignificant

Figure 1: Impulse Response in Recursive VAR



This figure shows the impulse response functions showing the impact of a one-off rise in INTm growth rate on output, prices, monetary aggregate and exchange rate, with the dotted lines representing 95% confidence level and the impact of a unit rise in the growth rate of monetary aggregate on other variables.

Table 5: Variance Decomposition (Percent of Total Variance)

Variance Decomposition of GDPA						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTMA**	**NEERA**
1	0.067191	100.0000	0.000000	0.000000	0.000000	0.000000
4	0.077274	95.61735	0.747174	3.247708	0.337880	0.049888
8	0.077403	95.55325	0.755237	3.277852	0.359609	0.054049
12	0.077405	95.55067	0.755621	3.277949	0.361010	0.054747
Variance Decomposition of CPIA						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTMA**	**NEERA**
1	0.008903	1.015293	98.98471	0.000000	0.000000	0.000000
4	0.009952	1.899751	81.56250	0.100684	8.907859	7.529210
8	0.010235	1.914807	78.09226	0.128086	10.33863	9.526215
12	0.010288	1.917015	77.46623	0.130873	10.55684	9.929040
Variance Decomposition of M2A						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTMA**	**NEERA**
1	0.009551	0.308828	1.161612	98.52956	0.000000	0.000000
4	0.009617	0.678184	1.982264	97.19940	0.107697	0.032459
8	0.009620	0.685572	1.988073	97.15250	0.133768	0.040086
12	0.009620	0.685725	1.988910	97.14739	0.136041	0.041934
Variance Decomposition of INTMA						
Period	S.E.	GDPA	CPIA	M2A	INTMA	NEERA
1	0.389118	0.700276	0.140861	0.108984	99.04988	0.000000
4	0.505393	3.529952	3.985635	4.734654	87.66348	0.086276
8	0.512978	3.528730	4.259895	4.819651	87.29407	0.097652
12	0.513331	3.529012	4.276629	4.819884	87.26525	0.109224
Variance Decomposition of NEERA						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTMA**	**NEERA**
1	0.004518	0.283709	5.497382	0.090923	1.655793	92.47219
4	0.007174	0.545544	10.47459	0.265867	5.794468	82.91954
8	0.007993	0.731029	11.54858	0.218461	8.591484	78.91045
12	0.008165	0.777887	11.77393	0.215670	9.328558	77.90395

This table shows the variance decomposition of the five variables VAR covering 1 to 12 quarters. The second column in each sub-table shows the forecast errors of the variable for each forecast horizon. The remaining columns present the percentage of the variance due to each shock, with each row adding up to 100.

Table 6: Variance Decomposition of VAR (Repo)

Variance Decomposition of GDPA:						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTRA**	**NEERA**
1	0.071468	100.0000	0.000000	0.000000	0.000000	0.000000
4	0.082012	94.62480	1.382626	3.424394	0.355899	0.212286
8	0.082096	94.59207	1.390798	3.435846	0.359099	0.222188
12	0.082097	94.58933	1.391206	3.435795	0.359456	0.224209
Variance Decomposition of CPIA:						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTRA**	**NEERA**
1	0.009595	1.302966	98.69703	0.000000	0.000000	0.000000
4	0.010676	1.775495	81.55952	1.970865	7.730516	6.963607
8	0.010884	1.730996	79.14847	1.915285	8.505136	8.700115
12	0.010921	1.723015	78.72026	1.905542	8.610425	9.040754
Variance Decomposition of M2A:						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTRA**	**NEERA**
1	0.008841	0.701716	0.345849	98.95243	0.000000	0.000000
4	0.008876	0.762420	0.413269	98.41496	0.037637	0.371711
8	0.008882	0.762074	0.425920	98.30062	0.048837	0.462552
12	0.008883	0.761997	0.429913	98.27425	0.054278	0.479562
Variance Decomposition of INTRA:						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTRA**	**NEERA**
1	0.352308	0.308717	0.466141	1.921718	97.30342	0.000000
4	0.413797	2.023479	5.832656	1.886932	89.95875	0.298180
8	0.415126	2.024507	5.909361	1.876778	89.88886	0.300489
12	0.415136	2.024533	5.909992	1.876696	89.88830	0.300480
Variance Decomposition of NEERA:						
Period	**S.E.**	**GDPA**	**CPIA**	**M2A**	**INTRA**	**NEERA**
1	0.004997	0.453490	6.613098	0.393814	17.40211	75.13749
4	0.007863	0.405743	11.70457	0.392003	17.68611	69.81157
8	0.008662	0.421778	12.40114	0.407970	18.38188	68.38723
12	0.008814	0.425498	12.52219	0.410484	18.52898	68.11285

This table 6 shows the variance decomposition of the forecast error in the VAR. The results shows a one-unit rise in Repo growth rate, the GDP growth rate rises by about 0.4% at the peak at the second quarter and decreases to 0.08% in the fourth quarter; the CPI growth rate rises at the peak by 0.2% in the second quarter.

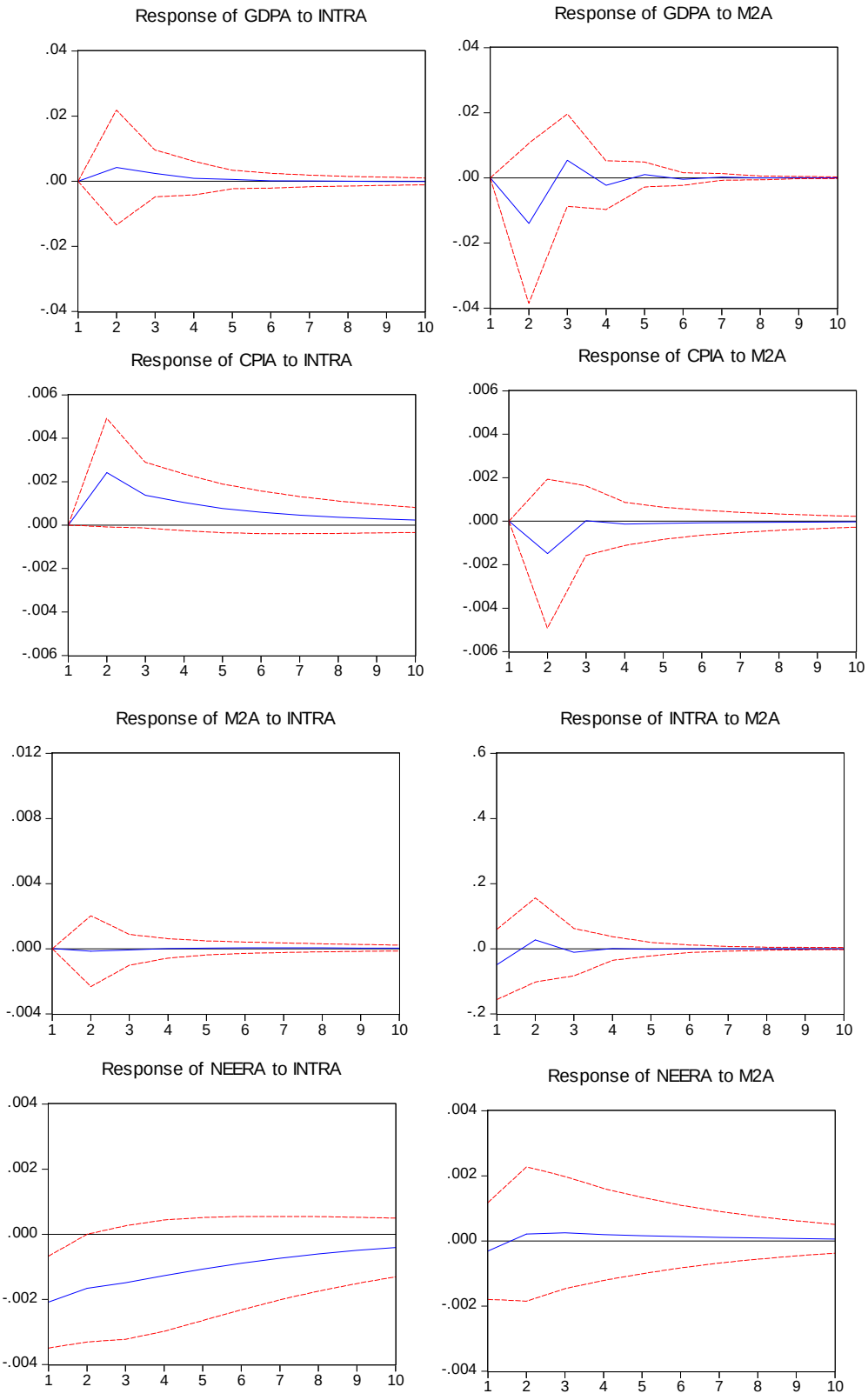
CONCLUDING COMMENTS

This study examines the transmission mechanisms of monetary policy in China, based on a VAR framework. Our findings suggest that level moving equilibrium did not exist among short-term money market interest rates, monetary aggregate, nominal effective exchange rates, and macro-economy variables (GDP and price level). However, in a differenced VAR, an exogenous, unexpected and temporary rise in the growth rate of money market short-term interest rates shows insignificant effect on the change rates of the real GDP and the price level. The impulse response functions and variance decompositions show that short-term money market interest change move along with money aggregate change rate, not the reverse. These findings show that under the current monetary aggregate targeting regime in China, a move in the short-term money market interest rate has not been able to reflect the changes in macro-economy variables. In other words, the response of the central bank's benchmark interest rate to macro-economy fluctuations fails to transfer effectively to the money market. The weak link between the short-term interest rate and the macro-economy variable implies that China cannot use the short-term money market interest rate as it operation target. An institutional reason for this failure is the existence of two cut-off separate interest rate systems: the central bank interest rate system and the commercial bank loan and deposit interest rates system.

After 2003, the PBC has adopted a contractionary monetary policy, namely, increasing the central bank bills to reduce the money supply. Therefore, the PBC could not influence the money market short-run interest rate. In this situation, the interest rate on the central bank bills rather than the money market interest rate, acts as the central bank target interest rate (Wu, 2008). To switch to an official interest rate as a policy instrument and to adopt a short-term money market rate as operation target, China needed first to establish an effective interest rate transmission channel, so that the PBC can effectively influence the short-term money market rate through OMOs.

It should be noted that the sample size in the study is not particularly large, which may limit the robustness of the tests and estimates presented here. The small sample has also prevented a reliable structural break analysis when it comes to cointegration testing. Therefore, future research that addresses similar issues should conduct with a sufficiently large sample so that one can investigate if structural breaks have taken place, and, if they have, what are their impacts on the long-run relationships between the variables.

Figure 2 Impulse Response in the Recursived VAR (Repo)



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