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Volume 3 **Table of Contents** 2012

Assessing the Economic Value of Pricing Information in a Monopolistically Competitive Market

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Abstract

Monopolistically competitive markets typically have differentiated products with price dispersion. Providers have some degree of pricing power, have some degree of competitiveness, and can easily enter and exit the market. Consumers and providers have limited or imperfect information. Past economic studies have debated why product and price dispersion exist in such a market and how imperfect information can limit and even eliminate the value of pricing information and price elasticity measures. In this article we show how product differentiation and price dispersion occur, how pricing power develops, and how pricing information provides value in multiple ways to decision makers.

Introduction

The purpose of this study is to examine how decision makers in a monopolistically competitive market use pricing information. We expected to verify that pricing information and analysis had limited value in such markets for a variety of reasons that are documented in the Earlier Research section of this article. What we found was that pricing analysis has value on multiple levels. We will show how product differentiation and associated pricing dispersion supports third-degree price discrimination for providers of services. Pricing analysis also identifies what signals and options consumers use to value products and services. Although pricing cannot be used to optimize revenue, it can be used to identify how changing prices affect revenues. And finally, it can be used to make shutdown decisions. Monopolistically competitive markets are different than other types of economic markets including perfectly competitive markets, monopolies, and oligopolies. Extrapolating the findings on the economic value of pricing information and analysis to other types of markets is not done in this study.

Monopolistically competitive markets share some characteristics with perfectly competitive markets and other with monopoly markets. They typically have large numbers of consumers and providers, ease of entry and exit, some degree of product homogeneity, and some degree of pricing power. But the degree and importance of pricing power, product differentiation, and competitiveness characteristics can differ across different monopolistically competitive markets. This study explains how imperfect information shapes the market characteristics of a specific, monopolistically competitive market. The consequences of imperfect information include extended product differentiation, rising pricing power, and can support third-degree pricing discrimination. Two consequences of imperfect information are the absence of a clear market price to judge competitiveness and fairness of pricing with an increased difficulty to calculate pricing measures, such as price elasticity to guide optimal decision making.

All monopolistically competitive markets have to be competitive to some degree. We expect that pricing power, which is the ability of individual suppliers to set prices, is limited if it exists at all. The U.S. Justice Department uses a variety of measures to assess the concentration of industries or markets. As concentration ratios decrease, they believe competition increases and pricing power decreases. In effect, when concentration ratios reach low levels, then price makers become price takers. In theoretical terms, individual providers of services are supposed to look to the market to provide a clear market price that everyone knows and can use. Concentration ratios for the top 4, 8, 20 and 50 companies are reported by the Bureau of the Census and used by the Justice Department to assess pricing power and the potential downside effects of pricing power on consumer welfare. But is it possible that a market with low concentration ratios can have pricing power? The answer is that pricing power can be shown to develop in a monopolistically competitive environment where information is imperfect.

The North American Industry Classification (NAICS) System was put in place to collect and report information on the concentrations of different industries. But it does not take into account any measurements of how perfect the information is. As shown in this paper, such an omission makes decision made about pricing power in monopolistically competitive markets questionable. For example, according to the latest Census Report on Arts, Entertainment and Recreation Industry (NAISC code 71), the top 50 providers are 2.5 percent of all establishments.[1] With 100,656 establishments surveyed by the Bureau of the Census in 2007, this industry is highly competitive. So there should be little, if any, pricing power. Within this industry are the Professional Industry Writers (NAICS 711510). Personal Historians (PHs) are within this group, and the market they work in has imperfect information. This article studies Personal Historians (PHs) and how they have created pricing power in a monopolistically competitive market.

PHs are professionals who document personal histories, memoirs, ethical wills, and albums for persons, families and corporations. The Association of Personal Historians (APH) is a global, professional society of PHs. Services and products are delivered across multiple media including video, audio, books, transcripts, and electronic formats. APH members are commonly sole practitioners who can be located anywhere around the world but generally work with clients in selected local geographies. Relationships and friendships are often formed with their clients because their work is personal. Tradeoffs between good business, economic objectives, and social and personal goals are made. The value of pricing information is expected to be limited.

Information is imperfect in this market. No clear market price or competitive PH prices are visible for providers or consumers to make decisions. Clients select a PH for a personal history project based on market signals (such as recommendations from past clients). Agendas of clients and PHs are often not well-defined and may not necessarily be aligned. Moral hazards occur when principals do not have clear agendas, or their agendas change during the course of a project. For example, a client may tell a PH that they want to have a book written, but during the course of the project, the client decides that their story is so good that it should be a script for a movie. Also, family members who review a personal history can suggest changes that are inconsistent with the views of the family member paying for the personal history project.

Since the market for personal histories allows for ease of free entry and exit, it offers a wide range of products and services, pricing choices at the individual PH level fit the monopolistically competitive mold. In order to analyze pricing decisions in the monopolistically competitive PH market, a literature review was done to determine appropriate methodologies and variables to build and estimate pricing formulas, assessing the value of pricing information to decision makers. Based on earlier research, data was collected on quantity and price choices as well as a range of market signals and qualitative measures. Statistical approaches were selected and applied to test key hypotheses to assess the value of pricing information.

Each step in the pricing analysis presented challenges. The literature on pricing decisions in a well-defined, monopolistically competitive market was found to be limited. Research revealed that most of the literature addressed pricing decisions without regard to the type of economic market, did not address imperfect information, and focused on supply-side modeling. Based on these realities we narrowed our focus to explaining why pricing dispersion exists and to tracking the consequences of imperfect information on pricing analysis and decision making.

Data was the biggest challenge. Large public data sources, such as the Bureau of Labor Statistics and the Current Population Survey, are too high-level to be applied to the PH market. Our data solution was to create and distribute a custom survey to APH members. The survey focused on variables of interest, based on the literature review. Statistical analyses examined how product differentiation, market competitiveness, and the use of market signals affect the value of pricing information. Our statistical analysis solution was to estimate a pricing formula by using traditional price and quantity measures as well as key product differentiators, market signal measures, and techniques used by PHs to build trust and relationships when information is imperfect.

Prior to this survey and analysis, PHs had no market pricing data or market price values to determine if their prices were fair and competitive. In fact, members were told not to discuss pricing on the APH Web site for fear that price fixing could be alleged. This study and the presentation of findings at the Annual APH Conference in Las Vegas in July 2011 opened the door to assessing the value of market pricing information and identifying those factors that consumers and PHs found important to make decisions in 2010.

Earlier Research

Our initial literature review of pricing analysis and decision making identified text books, scholarly articles, and applied studies on methods, applications and estimations of key measures. Unfortunately, few articles addressed the value of pricing information for service organizations, especially sole proprietorships and small businesses in monopolistically competitive markets. This is not surprising since commonly-used research databases (such as Wharton's WRDS and the Bureau of Labor Statistics) do not provide the granularity needed to analyze and report answers to the types of questions posed for this market. Given this situation, our literature review broadened to include the research associated with the list of specified study questions even if the research did not directly relate to service providers and the known characteristics of the personal history market. The results shown below were surprisingly robust and allowed us to examine a wide range of key economic questions, such as the causes for the dispersion of prices in monopolistically competitive markets.

As shown later in this article, the monopolistically competitive market for personal histories is characterized by pricing dispersion. Pricing dispersion has been researched and discussed for different markets since the mid-1970s. Riley (1976) examined the importance of the information transmission process when prices are dispersed. Building on the works of Spence (1974) and Stigler (1961), the assumption that information costs are negligible was replaced with the more realistic concept of asymmetric information. In such cases information is imperfect. For example, in the screening process for human capital, the costs of placing an individual in a job for which they are well-suited are not negligible. When the nature of a job is also

uncertain, plausible information about the value of an individual's work is revealed slowly over time; and the high costs of monitoring job performance lead to classical principal-agent problems and pricing dispersion. Regarding market signaling, this study also warns that while education can transmit information about job applicants and their potential productivity, more analysis is needed to clearly understand the two roles. Market signals do not automatically decrease pricing dispersion. In the personal history market, the roles of two market signals (experience and past pricing) are examined on the buyer side of the monopolistically competitive market. The question asked is: do buyers use such signals to determine the quality of differentiated products and reduce pricing dispersion?

Lettau (1997) addressed the importance of comparing apples and oranges when examining pricing measures. In the market for PHs, the apples and oranges problem manifests itself in product differentials and differences in quality. We acknowledge the important role that product differentiation plays in pricing dispersion for PHs. Bolton (2003) found that poor writers authored shorter texts and spent less time before beginning to write. In the market for personal histories, faster turnaround can be viewed as a signal of lower quality. Quality also is expected to be important in the market for personal histories.

Continuing on the topic of quality and market signals, past pricing (and higher past pricing in particular) is expected to be an important signal in the market for personal histories. Earlier research warns that this may not be true. Bolton (2003) found that consumers are wary of price increases and can view them as a sign of gouging. In such environments, she concludes that is it logical to assume that such practices lead to non-purchase, bargaining or search for alternative vendors. In contrast, Dagenais (1976) found that high prices can be an effective way to prevent new entries in homogeneous, oligopolistic industries with price leadership. Clark and Philips (2008) also found that higher prices and lower quantities were preferred to lower prices and higher quantity as business models for publishers. One of the reasons for this preference is the need to have more employees or subcontracts doing specialized pieces of the production. While Lazear (1986) finds that piece rates may be less than salaries, the results depend on the productivity of the subcontractors. Both piece-work subcontractors and employees increase costs. And in such cases, the resources needed to manage communications and projects increase. Pricing is a complex function for PHs. Signals that are sent to buyers by past prices, and maintaining consistent and rising prices over time will be analyzed. Setting prices to establish barriers to entry and managing subcontractor versus employee costs will not be examined.

Lazear and Moore (1984) note that principal agent problems are supposed to vanish when there are no employees or unobserved actions with moral hazards. Suppliers can avoid such problems by limiting or doing all the work themselves. Since most PHs are sole proprietors, principal agent problems and moral hazards are expected to be insignificant. But since specialization of labor (i.e. designing, writing, and publishing skills) is visible, it is often difficult to do everything for a personal history project. When subcontractors are used to provide specific skills, principal agent and moral hazard risks can emerge. However, even in such cases, PHs claim to have at least some level of moral sensitivity. As shown in Stevens and Thevaranjian (2010), once such moral solutions are included, the levels of disutility and potential negative effects of moral hazards should theoretically be reduced (if not eliminated) with pricing dispersion related to such practices being eliminated.

In Manning (1976), the effect of imperfect information on sellers was studied. Again, Stigler's work was cited for its explanation of why the dispersion of prices occurred. This study cited Rothchild's (1973) hypothesis that sellers who could learn about buyer behavior and act in their best interest would reduce and eliminate price dispersion over time. According to Manning, such hypotheses endow suppliers with greater knowledge which is only plausible in markets with specialist traders. When non-specialist suppliers facing probabilistic demand were introduced, such as used books, furniture, and housing markets, the dispersion of prices reemerged. Consumers are non-specialists when they do not know the number of customers before them or the depth of the market. For individual PHs, choosing multiple media specializations (print & audio, video & album, etc.) rather than one and only one medium provides consumers with different pricing choices. Coupled with the high costs of becoming better informed, a level of specialist expertise is foregone.

Market signaling is one way that buyers and sellers in a monopolistically competitive market can assess and deduce the quality of products and services. In the market for Personal Histories, the signaling is an essential factor that drives interaction, building trust and allowing a relationship to form between parties. This is similar to the process that was analyzed and reported on by Chen, Chien, Wu, and Tsai (2010). In their case, three signals were found to be important in the trust-development process. They were: brand image, Web site investment, and privacy policies. The authors found that these signals were not only important to building trust but also to retaining customers, which can also explain stickiness or customer loyalty.

The connection between pricing and signaling was established in Manzano (1999) who found that imperfect information in financial markets was associated with the dispersion of pricing, supporting Riley's earlier work. The article went on to show that such results extended Lundholm's results about the relationship between pricing and signals to financial markets with risk (Lundholm, 1988). On a practitioner level, Riston (2009) reminds us that low pricing or dropping pricing contradicts branding positioning benefits. For PHs, higher prices will be examined from a positive branding perspective.

One of the most important signals tied to quality when products and services are not homogeneous is past performance. Baker and Hwang (2008) used an adverse selection model to study the importance of various signals in Internet markets where quasi-experimental data could be easily collected. For online accounting service providers, they found that both professional certification and the signals pertaining to the providers' quality of interactions with past clients were statistically important. Signaling theory and reputation were also studied by Basdeo, Smith, Grimm, Rindova, and Derfrus (2006). They found that both reputation (the own actions of an organization) as well as the actions of rivals affected market share. For example, in cases where rivals set a high quality and customer service standard, an individual provider needed to establish a quality of service reputation to be successful. Other studies, such as Gittleman and Pierce (2011), indicated that an associate's past work experience and other qualitative characteristics of service providers set current prices in labor markets. Findings suggest that knowledge is the most statistically-important factor (among 8 tested) in determining quality. They connected knowledge and work experience, by noting it, was often learned on the job. For PHs, work experience will be examined to determine if it signals higher quality to buyers of personal histories. .

Practitioners, such as Laurens (2011), openly discuss the importance of past "successes" in determining current demand and pricing. For example, fiction genre audience Bloggers purchase by author (performer). In competitive genre markets, new authors are required to offer low prices to attract consumers. In the personal history market, experience alone is not expected to be associated with higher prices. PHs with equal experience that offer different products, such as audio CDs versus video DVDs, are expected to attract consumers in different value groups.

Ho and Huang (2010) used a Bayesian decision model to study the dispersion of costs as yet another reason for price dispersion in monopolistically competitive markets. They make a case that providers who continue to learn about costs and properly allocate costs when competitors enter the market can achieve economically optimal results. Those that don't continue to learn (they call it having a high forget rate), focus on the fixed (or production costs) and adjust to competitor entry are not optimally allocating costs for pricing. Our analysis does not address cost analyses and optimal allocations of costs for mark-up pricing by PHs. Future research will seek to incorporate such considerations in the pricing analyses.

Price elasticity or sensitivity has also been studied for monopolistically competitive markets. Nishimura (1986) was one of the first economists to specify market conditions that were consistent with high price sensitivity from low price sensitivity. Highly sensitive markets are those where information is perfect (or nearly perfect), unanticipated disturbances don't exist, and firms determine their prices before they have information about other firms' prices. They find that when the market becomes very competitive (with individual consumer's price elasticity close to infinity), average prices are completely insensitive to unanticipated disturbances. In other words, dispersion of pricing did not exist. When disturbances are anticipated or are uniform, then average price is sensitive to cost and insensitive to demand. With regard to the personal history market, disturbances at the project level can be unanticipated. For example, persons telling their stories may pass away before they can complete their interviews, subcontractor performance can fail to meet standards, and personal events can occur that disrupt, if not stop, a history project. Since virtually all PHs are sole practitioners, these disruptions can and do happen across the market and are expected to contribute to price dispersion.

Another reason for dispersion of prices was presented by Deneckere and Rothschild (1992). They showed that the distribution of preferences directly translates into the properties of the aggregate demand relationship. The authors cite Dixit and Stiglitz (1977), showing that assuming a market in which preferences and value are determined by a benefits function (symmetric aggregate demand model) the amount of competition that the monopolistically competitive market can support and achieve optimal results for consumers and firms. Based on their findings, the dispersion of prices reflects the diverse preferences of clients for differentiated products and media in the Personal Histories market. Price elasticity calculations are difficult to summarize since preferences and product options shift the demand curve, creating a family of different values for different client groups. Dickinson (2002) goes on to emphasize that estimating price elasticity can seem unreasonably simple but, when done, is useless.

Earlier research found that the actual estimation of price elasticity is difficult because multiple factors can move at the same time. Taking such movements into account, Dickinson finds that the simple price elasticity formula is subject to considerable error. What Dickinson and other economists did not consider is that in markets with product differentiation and pricing dispersion, buyers can signal their choices, and PHs can use third-degree price discrimination to segment buyers into groups. Price elasticity calculations and analyses for different-value consumer groups will be done to determine if such pricing information is indeed useful in managing revenues.

Doctorow (2010) studied third-degree price discrimination for digital products and found it difficult to calculate useful price elasticity measures to determine markups for different client groups. Unlike Doctorow, whose research focused on mark-up pricing, our research will examine the potential for product selection by buyers when multiple products and quality combinations are possible. Finally, Green (1992) found that increases in pricing greatly diminished the proportion of people willing to pay for consumer goods, such as housing or hardback books. But the results were more directional than quantitative. With differential products to choose from, movements away from a higher-priced product can be toward a lower-priced product. In another piece, Green (1992) analyzed the willingness to pay for private and public goods. He found

that the willingness of different groups of consumers to pay for private and public goods varied over time. The value of price elasticity measures over time was questioned. Our study of PHs is for one period of time (2010), and we acknowledge that extrapolations to other periods could produce varying results.

Asymmetric information also affects pricing analyses and outcomes. As Mooradian and Yang (2001) showed, asymmetric information not only led to principal agent problems, but it also led to a lemons problem in the real estate leasing market. In the Personal Histories market, asymmetric information is present because clients tell their view of their life story to the PH who records and packages it. There is a no requirement or test that all the information be factual. It is the personal view of the client.

The literature search revealed the importance of product differentiation in monopolistically competitive markets and its connection to the dispersion of prices. When imperfect information is added into the formula, then market signals, such as past pricing, reputation, and years of experience, were found by researchers to be useful when explaining price diversion. Limitations were found to exist in calculating and using price elasticity measures when optimization decisions are the objective. But no earlier research examined the value of pricing information for product selection, pricing discrimination, and increasing revenues for different consumer value groups. The methodological approaches and analyses that follow take into account the findings of past economic researchers, address uses of pricing information where pricing discrimination is possible, and identify areas where more research needs to be done.

Data and Methodology

Data

A survey was created for this study using a Web survey tool. The methodology to design the survey and collect the responses was based on the Pricing Model Methodology requirements. Product differentiation, dispersion of pricing, and consumer segments with different values for personal histories were areas of special interest. Twenty (20) questions were asked of the PHs in three (3) areas: Personal Profile Data, Personal History Business Data, and Business History and Pricing Data.

Personal Profile Data included identification information for the responding PHs. The confidentiality of respondents was provided by the survey team at The Satorian Group. PHs were asked how many years they had worked as Personal Historians, what geographic area(s) they served, and how many hours they worked per week on personal history projects. The years of experience and hours spent working per week provided key data on value of market signals that clients could use to establish reputation, trust, and relationships with PHs.

Personal History Business Data focused on product differentiation. Specifically, PHs identified the media that they worked in and the types of products that they provide. For example, a historian that works in print media could provide an album, a transcript, or a book as their final product. Another example is a historian who works in photo media who provides an album or DVD as their final product. Ultimately, PHs could provide a combination of final products, further diversifying their business model and the data collected. Audiences for Personal Histories, such as family members, businesses, or government organizations were identified. Lastly, this section asked PHs to record how many clients they had served in the past 5 years ending in 2010 and the average time to completion for their personal history projects.

In the Business History and Pricing Data section, PHs were asked how they create a market presence and sustained demand for their products. PHs were asked if they advertised, taught classes, and attended speaking engagements or trade shows. They were also asked about their client base.

In summary, the data survey was designed to support an analysis of how product differentiation and the dispersion of pricing could develop, potentially leading to pricing power and even supporting third-degree pricing discrimination over a period of five years in a market with imperfect information. The ultimate standard set for the data survey and collection was to be able to identify a statistically robust set of market signals, determining their value from an estimated pricing formula and price elasticity measures for consumer segments with different values.

Pricing Model Methodology

The pricing equation is specified in formula 1. Prices for personal histories in 2010 are related to the quantity of projects completed in 2010 as well as product-differentiating measures and market-signaling measures. The formula for the pricing equation is:

$$P2010 = \alpha + \beta_1 (Q2010) + \beta_2 (Video) + \beta_3 (Years) + \beta_4 (Hi\ Price) + \beta_5 (Price\ Floor) + \beta_6 (Quick\ Turn) + \varepsilon \quad (1)$$

where
P2010	is the average price of the Personal Histories done by respondents in 2010
Q 2010	is the number of projects completed in 2010
Video	is a binary indicating if the Personal Historian responding offered Videos
Years	is the years of the respondent has been doing Personal History projects
Hi Price	is the high price of a Personal History projects completed in the past 5 years
Price Floor	is a binary indicating if clients have paid at least $35,000 for projects over the past 5 years
Quick Turn	is a binary indicating that the PH provides fast-turnaround services for projects.

A linear, cross-sectional pricing function was estimated using the average PH price for histories delivered in 2010 as the dependent variable. The independent variables include the quantity of personal history projects sold, product differentiating factors, and market-signaling factors. The pricing function is for an individual PH and reflects both factors that move prices along a PH's demand curve (quantity of projects done in 2010) and those that shift the demand curve. Several of the shifting variables are binary variables since continuous information is not available in this market.

The variable values were provided by the PHs in Satorian's 2011 APH Pricing Survey. Pricing and quantity measures were those recorded for the 2010 calendar year. The independent variables are:

- Q 2010 – This variable is the number of personal history projects sold in 2010. As the number of projects sold increases, the Law of Demand is expected to hold. Higher quantities purchased are at lower prices. With imperfect information in a monopolistically competitive market, the strength of economic connection between price and quantity is expected to be limited. While the sign of the coefficient for Q 2010 should be negative, it is not expected to be significant.
- Video – Some PHs offer personal histories that are printed while others offer audio or video products. Many PHs offer multiple media formats to customers. All else being constant, in today's digital marketplace, video personal history projects are expected to be higher-priced than personal histories in other media. A binary variable is turned on when a PH offers video personal history products, and they are turned off when a PH does not offer them.
  The Video binary variable represents a product-differentiating option, which is one reason for the dispersion of prices in the market for personal histories. Previous studies by Deneckere and Rothschild (1992) and Dixit and Stiglitz (1977) established that in monopolistically competitive markets where preferences and values are incorporated, such binaries shift the pricing equation.
- Years of Experience – The years of experience a PH has in 2010 is viewed as a market-signaling measure for reputation and credibility that shifts the pricing equation. As shown by Chen, Chien, Wu, and Tsai (2010), such measures are critical to establishing trust and in establishing quality. Pricing dispersion is likely to occur as shown by Baker and Hwang (2008). The higher the years of experience, the higher the 2010 price of a personal history project.
- Hi Price – The highest price paid by consumers for a personal history from an individual PH in the last five years is a measure of quality and reputation. Higher prices are viewed as market signals that reflect the importance of past successes and quality as shown by Basdeo, Smith, Grimm, Rindova, and Dreyfus (2006). The higher that the highest price is paid in the past five years, the higher that the 2010 price of a personal history project will be. Hi Price shifts the pricing function.
- Price Floor – This binary variable differentiates a PH who only works with high-value consumer segments. Specifically, the high value consumer segments include those who pay $35,000 or more for a personal history. Such PHs have enough information to price discriminate. When the binary is turned on, then prices are expected to rise. We believe this is one reason that Doctorow (2010) and Green (1992) found it so difficult to calculate a single price elasticity measure and use it to assess the efficiency of decision making. Price elasticity and decision making are examined for three different consumer value segments in the analysis that follow.
- Quick Turn – This binary variable is turned on when a PH advertises faster project completions to customers than other PHs. When information is imperfect, Bolton (2003) and other researchers have found that faster turnaround can be associated with lower levels of effort and lower quality. When this binary is turned on, it is expected to be associated with lower prices for personal history projects.

The pricing equation as specified in formula 1 is estimated, and the results are analyzed in the Results Section that follows. The results confirm findings from earlier research and add knowledge gained about pricing discrimination and elasticity measurement as well the economic value of pricing information to both buyers and PHs.

Pricing Sensitivity Methodology

An assessment of decision making based on price sensitivity measures was also done. Although Dickinson (2002) and Mooradian and Yang (2001) both made strong cases that a single measure of price elasticity would not provide an accurate decision-making assessment tool for monopolistically competitive markets, they did not determine how a series of price elasticity measures for different consumer segments could be calculated and be used to assess decision making. In this study, we examine three different demand segments and their individual price elasticity measures. Optimal decision making to maximize revenue was not studied. A point elasticity measure is calculated for mean values in three different consumer groups with different values for PH goods. The identification of different value groups is possible because products are differentiated, and prices are dispersed. As described in the pricing equation, a high-value consumer segment has been identified by using a price floor binary variable. PHs can demonstrate that they can price discriminate if the price floor variable coefficient is significant. The price elasticity calculation for a consumer in a value segment is shown in formula 2:

$$P_{\varepsilon} = \beta\,(P_{im\,/}\,Q_{\,im}) \tag{2}$$

where (β) is the estimated coefficient for price in a reverse pricing formula and (P_{im}) and (Q_{im}) are the mean price and mean quantity of personal histories sold for a buyer segment. A reverse pricing formula converts the pricing formula structure and coefficients into a quantity formula with price as a right-hand variable. The three buyer segments used in the analysis are distinguished on the basis of prices paid in 2010. Buyers in the high-value consumer segment are those who purchased PH products sold in the top quartile of 2010 prices. The low-value consumer segment are those clients who bought products in the bottom quartile of 2010 prices, and the mid-value consumer segment are those who purchased PH products in the middle two quartiles of the price range. Information on the consumer-value segments and the price elasticity measures for each are provided in the Results Section.

Results

Data

Over forty percent of the PHs responded to the Association of Personal Historians (APH) survey. The 63 respondents indicated that they provided a wide range of products over the past five years. The average prices for the differentiated products were dispersed. The product differentiation and pricing dispersion provide an ideal environment for price discrimination. With multiple products and price offerings, clients can pick which products they believe are the best value, and PHs can decide what value segments clients fit in to.

With five basic product lines, PHs offer a variety of different history deliverables to clients. Table 1 shows that 89 percent of PHs write personal history books but 13 percent solely offer books. Reading across lines in the table shows the distribution of products and how it varies. For example, 33 PHs provide transcripts, but these 13 percent also write books, another 13 percent also create albums and catalogues, and 60 percent can deliver Video DVDs and Audio CDs. These results show that while PHs may specialize in a product line, they also offer multiple products to clients.

Product differentiation was also associated with pricing dispersion among the various products in 2010. Table 2 shows that PHs wrote books that sold for an average price of $13,375 in 2010. Video DVD products had the highest average price ($19,241) in 2010. Transcripts of personal history interviews (as a product) had the lowest average price of $8,321. Albums/Catalogues, and Audio CDs had average prices from $11,444 to $12,456. They form the mid-range of products and prices for PHs.

A more-detailed view of product differentiation and dispersion of prices are shown in Figure 1, which is found in the Appendix. Average project prices are ranked from high to low, and the ranking number of each PH is indicated on the horizontal axis. As shown, the PH with the highest price had an average price of $80,000, and the PH with the tenth (10) had an average price of $20,000. The mean or average PH price for products delivered in 2010 was $12,476 with a high price of $80,000 and a low price of $500. The dispersion of the prices is reflected in the standard deviation which is $15,107. If 68% of the pricing points are within +/- one standard deviation of the mean, then that implies that only 16% of the PHs have prices above $27,581. Kurtosis is measured at 8.439. Based on a mesokurtic, or a normally-high distribution kurtosis value of zero,

then the PH price distribution is much flatter than the normally-high distribution. Pricing dispersion is not only high, but it is so wide that it spreads out choices, ultimately supporting price discrimination.

Table 1: Multiple Product Offerings by Personal Historians

			*Percentages by Product**				
Products	***Count***	***% of All***	***Books***	***Album/Catalogue***	***Video DVD***	***Audio CD***	***Transcripts***
	(63 PHs)						
Books	56	89%	100%	14%	50%	50%	54%
Books Only	8	13%	-	-	-	-	-
Transcripts	33	52%	13%	13%	60%	60%	100%
Audio CD	33	52%	52%	18%	36%	100%	64%
Video DVD	17	27%	27%	20%	100%	67%	40%
Album/Catalogue	10	16%	16%	100%	33%	56%	44%

**Percentages by product only reflect the number of PHs who offer the product category as a final product.*

Table 2: Product Pricing Overview

Product	Count	% of All	Average Price
Books	56	89%	$13,375
Audio CD	33	52%	$12,456
Transcripts	33	52%	$8,321
Video DVD	17	27%	$19,241
Album/Catalogue	10	10%	$11,444

A total of 63 individual respondents' data was included for product pricing analysis.

Finally, the survey showed that PHs do not recognize competitors (other PHs in a local market) when pricing their products. A t-test comparison of pricing by PHs who recognized that competitors were present in their market location (versus those who did not recognize competitors) had prices that were not statistically different.[3] In this monopolistically competitive market without product homogeneity and with pricing dispersion, a case can be made that the competitive dimension of the monopolistically competitive market is limited. Clients and PHs do not have the information to compare prices offered and make decisions on the basis of an average or market price.

Pricing Analysis for Personal Histories

Product differentiation and pricing dispersion make if difficult to estimate a demand curve or pricing formula for PH products. With imperfect information, the estimation becomes even more difficult. But as shown in this section, a meaningful pricing formula can be estimated in this monopolistically competitive market, showing that PHs have pricing power and that market signals play an important role in making decisions. The results also indicate that third-degree pricing discrimination is present.

The pricing equation estimates are provided in Table 3. As shown, the set of explanatory factors explained over 85% of the movement of prices for personal histories in 2010. The F-statistic for the overall regression (52.04) was significant at the 1% level. Prices in 2010 did vary inversely to the quantity of personal histories sold by a Personal Historian in 2010, but the coefficient for Q 2010 was not significant. The t-statistic for quantity was (-1.015). These results are consistent with previous studies that showed when products are differentiated (similar but not homogeneous), and information is imperfect, then it is difficult to find statistically significant results for decision making. The coefficient indicates that in order to sell an additional personal history, a PH would have to lower their price by $907.00.

Also, as expected, video personal history products are associated with higher prices. The coefficient indicates that doing a video DVD personal history adds approximately $3,345 to the price of a personal history project. The coefficient has a t-statistic of (1.771), making it significant at the 5% level.

Table 3: Pricing Formula Estimates

Variables	Means	Coefficients	t-Statistic
P 2010	-	-	-
Q 2010	3	-907.8071	(-1.015)
Video	1 - Yes	3344.7033*	(1.771)
Years	4	1498.9703**	(2.082)
Hi Price	$30,593	0.1831**	(8.399)
Price Floor	0 - No	46454.2595**	(10.02)
Quick Turn	0 - No	-2632.5909	(-0.5772)
Intercept	1	1197.8075	(0.3214)
	R-squared	86.69%	
	Adjusted R-squared	85.00%	
	F- statistic	52.04**	
	Observations	54	

*Absolute values of t-statistics are in parentheses. Significance levels for t-statistic and F-statistic rates are indicated by * at a 5% level and ** at a 1% level. Binary Value means are designated as 1-Yes or 0-No indicating their value on average .*

The Years (of experience) factor is a strong market signal about reputation and credibility, which are both important to establishing trust. Prices rise with years of experience. For each year of experience, consumers are willing to pay an additional $1,499. With a t-statistic of (2.082), the relationship between years of experience and price is significant at the 1% level. It is consistent with cited studies that address the importance of market signals about quality when information is imperfect.

Similarly, past high pricing is found to be an important signal related to maintaining and establishing quality. According to the estimated pricing equation, the higher the prices paid to a Personal Historian in the past five years, the higher the price that consumers are willing to pay in 2010. Each $1,000 increment in past prices adds $183 to the 2010 prices that consumers are willing to pay. The t-statistic for this factor is (8.399) which is significant at the 1% level.

The $35,000 pricing threshold is also an important market signal to consumers. In fact, the results indicate that a Personal Historian who decided to maintain at least a price of $35,000 per personal history project in the past five years can ask and receive a price of $46,454 from consumers (if all else remains constant). This is a strong indication that pricing discrimination is possible for PHs who wish to work with only high-value consumers. The t-statistic (10.022) is significant at the 1% level. The message to consumers is that such a Personal Historian has the highest quality standards with a distinctive product in the marketplace. The message to PHs is that pricing discrimination is possible and active.

The Quick Turn binary is negatively related to price. These is consistent with consumer assessments that faster projects require less effort and are lower quality, therefore deserve lowering prices. The price effect means that consumers pay $2,643 less for PHs identified with fast turnaround labels. The significance of the t-statistic for the Quick Turn coefficient is (0.5772), however, which is not significant.

Lastly, the intercept is positive but not significant (0.3214). We interpret this as the subsistence price in the Personal Histories market. It is the price that would be charged if all the independent variables are zero.

In this monopolistically competitive market with product differentiation, pricing dispersion, and imperfect information, PHs have limited pricing power in terms of the slope of the pricing equation but substantial pricing power in terms of product differentiation and market signaling factors that shift the pricing curve. The results also indicate that at least some PHs have the ability to discriminate and work with only consumers in the highest-value segment.

Price Elasticity Results

Finally, price elasticity measures were also calculated to determine the usefulness of such measures to decision making. As noted in the literature search, single price elasticity measures are difficult to calculate and interpret. They have not been found to be useful in past studies of monopolistically competitive markets and optimal decision making. In this study, we found that there is substantial value in elasticity measures when considering different consumer segments. This study examined how pricing sensitivity measures varied across the different consumer segments, based on the values of groups place on personal histories. Three consumer segments were identified, and price elasticity measures were calculated for each. The identification of consumer value segments is possible because of product differentiation and the dispersion of pricing.

The 2010 value ranges for the three consumer groups are: high-value ($20,000-$80,000), mid-value ($4,000-$20,000), and low-value ($500-$4,000). As shown in the pricing analysis, some individual PHs can identify at least the high-value segment.

In Table 4, price elasticity measures are calculated and analyzed for the three consumer segments. The Low-Value Segment has the least value based on price. For the Low-Value Segment, their average value in 2010 was $2,250. PHs have four years of experience, their high price over the past five years was $4,000, and they do offer Quick Turnaround services to consumers. They do not offer Video histories and do not set a low price floor. The calculated elasticity for this consumer segment is -0.74, which is inelastic; so raising prices would increase revenue. The estimated number of personal histories sold by PHs in this segment in 2010 is 4. The economic value of this pricing analysis for this segment is that it runs counter to traditional economic thinking. Price elasticity is supposed to be a sign that scarcity is low, and competition is high. But in this monopolistically competitive market, competition is not high, and low prices do not mean more projects per PH.[2] The value of raising prices sends market signals that consumers recognize and are willing to respond to higher-priced projects as higher-quality projects.

The Mid-Value Segment's elasticity is price elastic with a value of -3.85. This means that for a percentage decrease in price, quantity sold would increase by 3.85 percent. The path to increasing revenues for this segment was the opposite of the Low-Value Segment. PHs in this market offered clients Video DVDs but had lower prices in 2010 ($12,000) than their highest prices in the past five years ($25,000) and did not generally offer Quick Turnaround choices or have a low-price floor. The number or projects done in 2010 was similar to the Low-End Segment. The difference in price between the groups was due to product differentiation. As shown in Table 5 in the Appendix, this PH group provided more books and videos while the Low-Value Segment PHs provided more albums and transcripts. Product differentiation was the key. Pricing increases or decreases was not the most effective way to increase revenue.

The High-Value Segment's elasticity was shown as -17.70. Substantial price sensitivity exists. A 1% decrease in price would increase quantity sold by 17.7%. In this segment, PHs offered clients a $60,000 average price in 2010, which was above their historical five-year Hi Price of $45,000 while setting a low price floor. Their years of experience are slightly higher than other pricing segments, and about one in five offered Video DVD personal histories. As a PH group they also sold more books than either of the other two PH groups. Table 5 in the Appendix shows the full mix of products. They did not offer Quick Turnaround services. The price elasticity calculation for this segment suggested that decreasing prices would increase revenue. But increasing the number of projects and offering lower prices could also raise costs more than revenue, leading to questions about quality. Another alternative to raising revenues without lowering prices could be adding an audio CD, Video DVD, or digital book with a hard-bound personal history book. Comparing the benefits and costs of these options was, however, outside the scope of this study.

Table 4: Price Elasticity Table

Variables	High End Segment	Middle Two Segments	Low End Segment
P 2010	$60,000	$12,000	$2,250
Video	No	Yes	No
Years Exp	5	4	4
Hi Price	$45,000	$25,000	$4,000
Low Floor	Yes	No	No
Quick Turn	No	No	Yes
Q 2010	3.7	3.4	3.35
Elasticity	-17.70	-3.85	-0.74

Previous studies that found limited or no usefulness for price elasticity measures to decision makers in monopolistically competitive markets failed to systematically include the effects of product differentiation and pricing as means to price discriminate. Over a five year period, PHs tend to specialize in specific products and send associated signals to consumers about their quality and reputation. This does not mean that PHs seek to maximize the value of their businesses over a five-year period, but rather that the importance of pricing meeting their objectives is both how it affects revenue and how consumers end up viewing their products in the marketplace.

Conclusions

This study of monopolistically competitive markets is a work in progress. This study of the market for Personal Histories verified past research that imperfect information is associated with product differentiation and the use of market signals to build trust and relationships. This article showed how product differentiation is also associated with pricing dispersion and pricing power. Product differentiation is valuable to consumers because it allows them to choose the best product to meet their budgets and values. While pricing measures at the market level may not be useful to optimize revenues, price elasticity measures for different consumer-value groups can be useful to PHs in making decisions on how to increase revenue. Price elasticity measures for consumer segments do offer insights that run counter to simple economic rules for a single pricing curve along a market or average pricing equation. Shifting of the pricing curve is the key to increasing revenues.

At the November APH Conference, PHs asked what the next step was in pricing and decision making. The answer was to provide a way for individual PHs to calibrate where they fit in a specific consumer segment. Bringing pricing information down to an individual PH member level opened the door to another use, or economic value for pricing and decision making. PHs sought to compare the value of their time with their individual prices and market prices. One use of such information was to determine if they should continue doing personal histories or exit the market. A Pricing Tool was provided to the APH members to assess shutdown decision. It is included in the Appendix as Table 6. Step-by-step instructions on how to use the Pricing Tool were provided with it.[4] If the value of a PH's time was found to be greater than the price that they can charge, then the PH should exit the market. Surprisingly, PHs understood and accepted this use of pricing information to make shutdown decisions. The results of their findings have not been tabulated at this time.

Acknowledgements

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Notes

[1] In 2007 the Economic Census done by the Bureau of Census reported establishment and firm size, and concentration by largest firms for Arts, Entertainment and Recreation entities in Table ECO77155526. The concentration measures reported were: 4 largest (0.2%); 8 largest (1.0%); 20 largest (1.3%); and top 50 (2.3%).

[2] PHs who said they recognized competitors existed in their market had an average price of $12,143 for their products versus PHs who did not recognize competitors and had an average price of $12,678. The two sided t-statistic value was (0.1351).

[3] The average number of projects done by PHs working with clients who value their work in the lowest quartile was reported to be 3.68 in 2010 compared to 3.58 for the middle two quartiles and 4.04 for the high quartile.

[4] In order to use the APH Pricing Tool, PHs needed to input the value of their time on an hourly basis, identify which Consumer Value segment they were in, and enter their own average prices for 2010. Then they entered cost information and the Pricing Tool calculated different income and return per hour amounts for their personal history work. The "Gaps" showed if their current return from doing personal histories was higher or lower or equal to the value they placed on their time.

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Appendix

Figure 1: Product Pricing and Dispersion

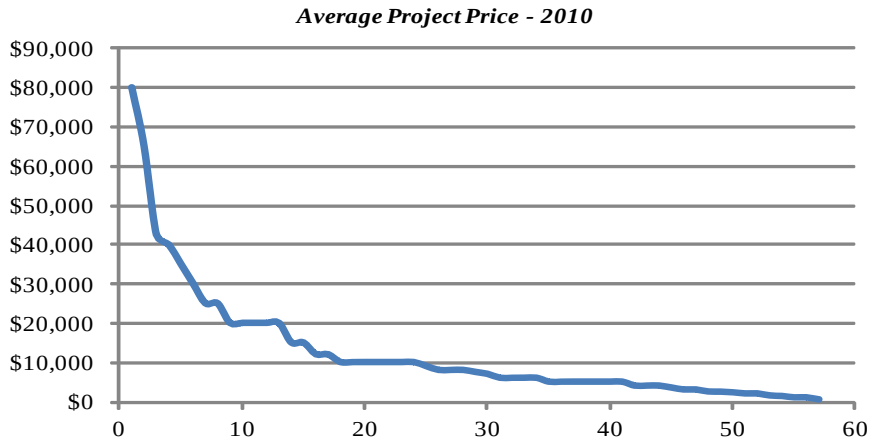

Table 5: Product Differentiation Overview by Consumer Value Segments

	High End Segment	***Middle Two Segments***	***Low End Segment***
Pricing Range →	($20-$80)	($4-$20)	($0.5-$4)
Mix of Products Supplied			
Books	60%	45%	15%
Transcripts	5%	15%	30%
Audio	13%	15%	15%
Video	20%	15%	5%
Albums +	2%	10%	35%

Table 6: APH Pricing Tool - Fall, 2011

	High End Segment	***Middle Two Segments***	***Low End Segment***
Pricing Range →	($20-$80)	($4-$20)	($0.5-$4)
Product Pricing (per Project)	$42,188	$12,950	$2,151
YOUR PRICING AMOUNT	$42,188	$12,950	$2,151
Projects Supplied (per Year)	4.04	3.58	3.68
Relationship Building Costs (Year)	$0	$0	$0
Subcontractor Costs (per Project)	$10,000	$2,000	$0
Subcontractor Markup Rate	25%	10%	0%
Frequency of Markup	20%	0%	0%
Business Expenses (per Month)	$2,500	$750	$150
Net Annual Income	$102,059.52	$30,201.00	$6,115.68
Net Monthly Income	$8,504.96	$2,516.75	$509.64
Net Weekly Income	$2,126.24	$629.19	$127.41
Hours Worked per Week	35	28	22
Return per Hour	$243.00	$89.88	$5.79
Return to Society Multiplier	1.0	1.0	1.0
Return per Hour to Society	$243.00	$89.88	$5.79
Value of Time	$50	$50	$50
Gap (Return minus Value)	$193.00	$39.88	-$44.21

Impact of Quantitative Easing Announcements and Events on Financial Markets

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Abstract

Starting in late 2008 the Federal Reserve used Quantitative Easing (QE) as a policy tool. Two recent studies use the event study method to investigate the impact of Quantitative Easing announcements and events on financial markets. This research critiques the event study method used in these studies and calculates daily cumulative abnormal percentage changes in interest rates for five event dates during QE 1. The results of this research are consistent with and strengthen the results of the other two studies.

Introduction

In general, Quantitative Easing, QE, is the attempt by a central bank to inject more money into the economy and to keep long-term interest rates low. This is done through the purchase of large amounts of financial assets which are often held by financial institutions. The event study method is used to study the impact of QE 1 events and announcements on interest rates and other market variables.

Quantitative Easing Channels

Krishnamurthy and Vissing-Jorgensen (2011) discuss the channels through which QE can be expected to impact interest rates in general and yields on government bonds specifically. They are: duration risk channel, liquidity channel, safety premium channel, signaling channel, prepayment risk premium channel, default risk channel, and inflation channel. Each channel has a prediction of how QE should move interest rates. They are: duration risk channel predicts that QE decreases treasury yields, liquidity channel predicts that QE raises treasury yields, safety premium channel predicts that QE lowers treasury yields, signaling channel predicts that QE would signal that Federal Reserve wants to lower treasury yields, prepayment risk premium channel predicts that QE lowers the rate on riskier debt instruments, such as mortgage back securities relative to treasury securities, default risk channel predicts that QE would primarily impact riskier debt instruments such as mortgage back securities, and inflation channel predicts that QE may increase or decrease interest rate volatility.

Event Study Method

MacKinlay (1997) reviews the event study method. Basically, the event study method compares the expected percentage change in the value of a financial asset relative to the expected percentage change in its value when an event occurs or is announced. If financial markets are efficient and the event or announcement is, to some degree, unexpected the impact on the value of financial assets should be quick and should persist. To illustrate, if a QE event is, in some sense, unexpected and is believed to have an impact to lower interest rates the percentage change in interest rates should be quick and should persist.

Figure 1: Illustration of pattern of cumulative daily abnormal percentage changes for interest rates when an announcement or event is unexpected and it implies interest rates should fall.

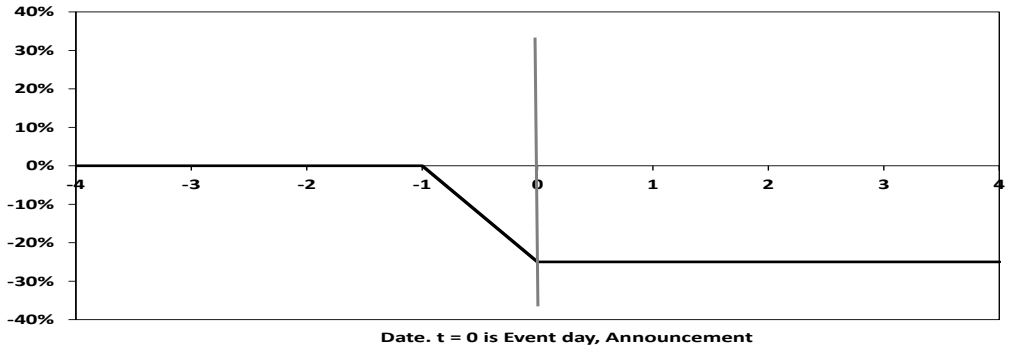


Figure 1 is a graphical illustration. The announcement or event date is t = 0. Prior to the announcement or event date, there is no difference between the actual and expected percentage change in interest rates. On the announcement or event date, the percentage drop in interest rates is greater than expected. After the announcement date, the cumulative percentage change persists.

Literature Review

Two recent studies investigate the impact of Quantitative Easing events and announcements on financial markets. They are: Gagnon, Raskin, Remache, and Sack (2011), henceforth GRRS and Krishnamurthy and Vissing-Jorgensen (2011), henceforth KVJ.

The GRRS study looks at 23 QE events/announcements. The first is on 25 November 2008 and the 23rd is on 17 February 2010. Of these 23 announcements eight are considered baseline. According to GRRS the baseline announcements contained new information concerning the potential or actual expansion of the size, composition, and of timing of the large-scale asset purchases. KVJ look at five of these eight baseline announcements. Table 1 contains the five baseline dates and briefly describes each announcement. These announcement dates are considered to be part of QE1, the first phase of QE.

Table 1: Five announcement dates used in both studies (GRRS and KVJ)

Number	Announcement Date	Event/Announcement
1	25 November 2008	Initial large scale asset purchase announcement
2	01 December 2008	Chairman speech
3	16 December 2008	Federal Open Market Committee Statement
4	28 January 2009	Federal Open Market Committee Statement
5	18 March 2009	Federal Open Market Committee Statement

Source: GRRS (2011, page 49)

Both studies look at the impact of the five QE events/announcements on interest rates for various debt securities. Table 2 shows the QE announcement or event impact on the basis point change for the 10 year U.S. Government bonds and basis point change in interest rate volatility on the event day and the subsequent trading day. For instance, on 25 November 2008 the market interest rate on 10 year U.S. Government bonds fell by 22 basis points and on this day and the next trading day the interest rate volatility increased 1 basis point. KVJ used Barclays implied swaptions volatility index, BBOX, to measure interest rate volatility.

Table 2: Basis points, bps, change in 10 year U.S. Government Bond on announcement date only and two day basis point change in interest rate volatility (days t = 0 and t = +1).

Announcement Date	Change 10 year U.S. Government Bond, bps, GRRS	Interest Rate Volatility two day change, bps, KVJ
25 November 2008	-22	+01
01 December 2008	-19	-07
16 December 2008	-26	-20
28 January 2009	+14	+/-0
18 March 2009	-47	-11

Sources: GRRS and KVJ

The GRRS and KVJ studies look at what happened on the event or announcement day or a two day event window, the event day and following trading day. They did not study the non-announcement or non-event dates. For instance, GRRS looked at bps changes only for the five dates above and no dates before or after. The changes they report are basis point changes of the interest rate and of the volatility index. They are not changes relative to what was expected, which is the standard event study method. This research adjusts for these research flaws.

Event Method

This research uses data for 103 trading days starting on 31 October 2008 and ending on 31 March 2009. These 103 data days are used to calculate 102 daily percentage changes of the interest rate on 10 year U.S. Government Bonds and the MOVE index. The MOVE index is the Merrill Lynch Option Volatility Estimate Index. It is a yield curve weighted index of the implied volatility on 1-month Treasury options which are weighted on the 2, 5, 10, and 30 year contracts.

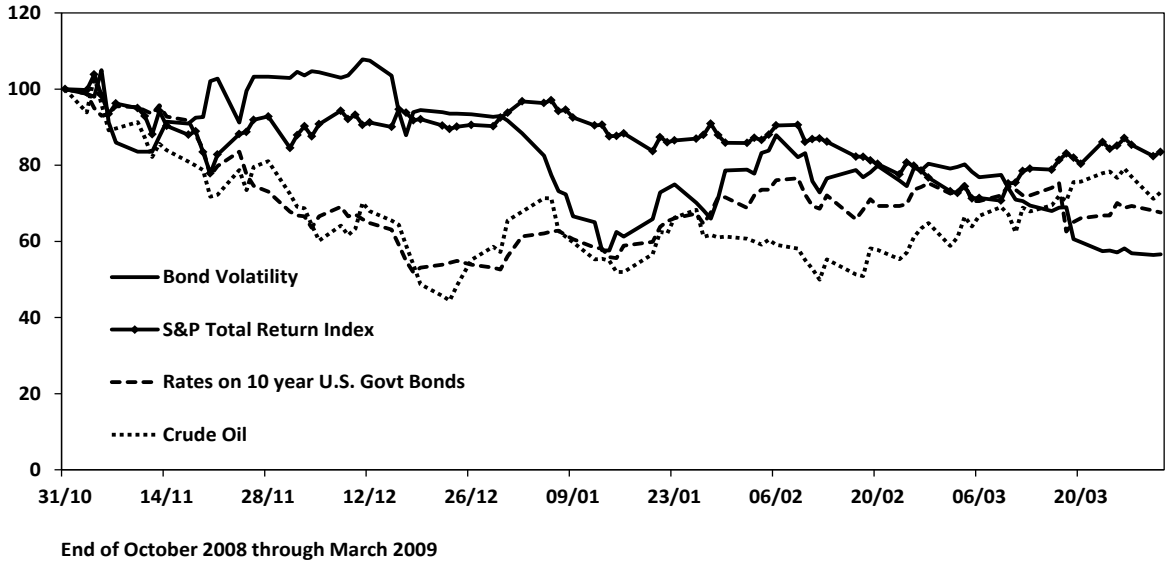
The 102 daily percentage changes are divided into 63 non-event days or the estimation period and 39 days for the test period. For each day during the test period, the daily abnormal percentage change is calculated. The daily abnormal percentage change is the actual percentage change minus the expected percentage change. The proxy for the expected percentage change is the average for all 63 days of the estimation period. For instance, for 25 November 2008, the first of the five announcement days, the daily abnormal percentage change is the actual percentage change of the interest rate on 10 year U.S. government bonds minus the average percentage change of the interest rate over the 63 estimation days.

For each announcement day the test period is from four trading days before the announcement to four days after or a total of nine test days. One exception is the first and second announcement dates. There are only two trading days between the first announcement on 25 November 2008 and 01 December 2008. Thus, these two announcements are combined and have 12 trading days during the test period.

Results

Figure 2 shows the general pattern of four economic and financial variables over the 103 trading days, from end of October 2008 through end of March 2009. The variables are the MOVE bond volatility index, the Standard & Poor's total return index, interest rates on 10 year U.S. government bonds, and price of West Texas Intermediate crude oil. The S&P total return index includes both price movement and dividends. All four variables are scaled to start at 100. In general, all of the variables fall during this time period. Rates on10 year U.S. government bonds and crude oil fell the most in November and December in 2008. The S&P total return index had the smallest percentage decrease.

Figure 2: Scaled values for Bond volatility, S&P 500 total return index, interest rates on 10 year U.S. Government bonds, and West Texas Intermediate Crude Oil



Sources: Bloomberg, Federal Reserve Bank St Louis, Chicago Board Options Exchange

Table 3 contains the statistics for the actual daily percentage change of the interest rate on 10 year U.S. government bonds for all 63 non-event days, the estimation period, all 39 event or test period days, and the 5 event days. The average or mean percentage change is positive, 0.1760%, for the 63 event days; is negative, -1.0840%, for the 39 event days; and is most negative for five announcement days, -6.5819%. These empirical results are consistent with the hypothesis that QE announcement would lower interest rates.

Table 3: Statistics for daily percentage change of interest rate on 10 year U.S. government bonds

Statistic	Estimation period	Test period	Event date
Observations	63	39	5
Mean	0.1760%	-1.0840%	-6.5819%
Median	0.0000%	0.0000%	-7.1642%
Max	9.3333%	5.9041%	4.6332%
Min	-8.6505%	-16.8874%	-16.8874%
Standard deviation	3.3247%	4.6462%	7.6278%

Table 4 contains the statistics for the actual daily percentage change of interest rate volatility, the MOVE index for the 63 estimation period days, the 39 test period days, and the 5 event days. The average or mean daily percentage change of the MOVE index is negative for the 63 non-event days, -0.6985, the 39 event days, -0.0422%, and the 5 announcement days, -0.6822. This indicates that volatility trended downward from end of October 2008 through end of March 2009.

Table 4: Statistics for actual daily percentage change of interest rate volatility, MOVE index

Statistic	Estimation period	Test period	Event date
Observations	63	39	5
Mean	-0.6985%	-0.0422%	-0.6822%
Median	-0.7235%	0.0468%	-0.3271%
Max	10.6227%	10.2165%	9.1005%
Min	-13.1034%	-12.1064%	-9.1375%
Standard deviation	4.3999%	5.0895%	6.6006%

Table 5 contains one day percentage changes for the S&P 500 Total Index, one-day percentage changes for the price per barrel of West Texas Intermediate Crude oil, and two-day percentage change in the USD/EUR exchange rate, for the five event days. The USD/EUR exchange rate is for the event date and the next trading day because the reported daily value of for 1:00 p.m. Eastern time.

Table 5: Event day statistics for actual one day percentage change in S&P 500 Total Return Index, WTI (West Texas Intermediate Crude oil, and two day percentage change in USD/EUR exchange rate (event day and event day + 1)

Event Date	S&P 500 TR, % change	WTI, % change	USD/EUR 2 day % change
25 November 2008	0.6704	-6.7313	-0.2321
01 December 2008	-8.9232	-10.6321	0.2397
16 December 2008	5.1364	-1.7260	3.9681
28 January 2009	3.3687	0.8879	-1.2870
18 March 2009	2.0893	-1.7358	5.7930

On 01 December 2008 the Dow Jones Industrial Average dropped 679.95 points and the S&P 500 Total Return index fell 8.9%. A *Wall Street Journal* article (Hilsenrath and Reddy) on 02 December 2008 contained the following: "A flurry of bearish news, including a decline in a key manufacturing-activity index, helped push the Dow Jones Industrial Average down 679.95 points Monday, or 7.7%, wiping out about half of last week's gains. It was the 12th-biggest single-day percentage drop and the fourth-sharpest point drop since the Dow was created in 1896." This bearish news on 01 December 2008 was most likely the explanation for the 10.6% fall in West Texas Intermediate (WTI) crude oil.

Another *Wall Street Journal* article on 02 December 2008 stated, "Treasury yields fell to historic lows Monday as the market rallied for a fourth session in a row, sending yields on 10-year government securities to their lowest levels in more than 30 years and the two-year yield back below the federal-funds target rate of 1.0%. Bracing global economic news and the prospect that the Federal Reserve could buy government debt to support financial markets and the economy combined to push prices higher -- led by the long end -- and push down yields."

A third *Wall Street Journal* article (Zeng) on this day stated, "The dollar ended lower against the yen but higher against most other currencies, after an array of weak economic data from around the world exacerbated fears of a protracted global downturn."

How much of the movement in interest rates on 02 December 2008 was due to an announcement by the Fed and how much was due to other economic and financial news? Was the Fed announcement a response to these other economic news?

From 1:00 p.m. on 17 March 2009 until 1:00 p.m. on 19 March 2009 the USD/EUR exchange rate increased 5.793 %. On 19 March 2009, the *Wall Street Journal* (Browning, Rappaport, and Slater) contained the following: "The dollar suffered, with the euro staging its biggest one-day percentage gain against the greenback since the pan-European currency was created 10 years ago. The dollar also fell sharply against many other currencies. The problem: The Fed is trying to drive market interest rates lower, meaning that investors will get lower rates on dollar-denominated securities." This same article also contained the following, "While many analysts said the Fed had no choice but to step up its efforts, they worried that the Fed's move could be another sign of economic weakness."

The above quotes from the *Wall Street Journal* for two event days indicate that there is an interaction between economic or financial news, actions by the Fed and interest rates. When using daily data what was an action and what was the reaction is difficult to determine.

Figures 3 through 6 show the cumulative daily abnormal percentage change of the interest rate on 10 year government bonds around the five announcement or event dates, t = 0.

Figure 3: Cumulative daily abnormal % change in rates for 10 year government bonds around event dates 25 November 08 and 01 December 08

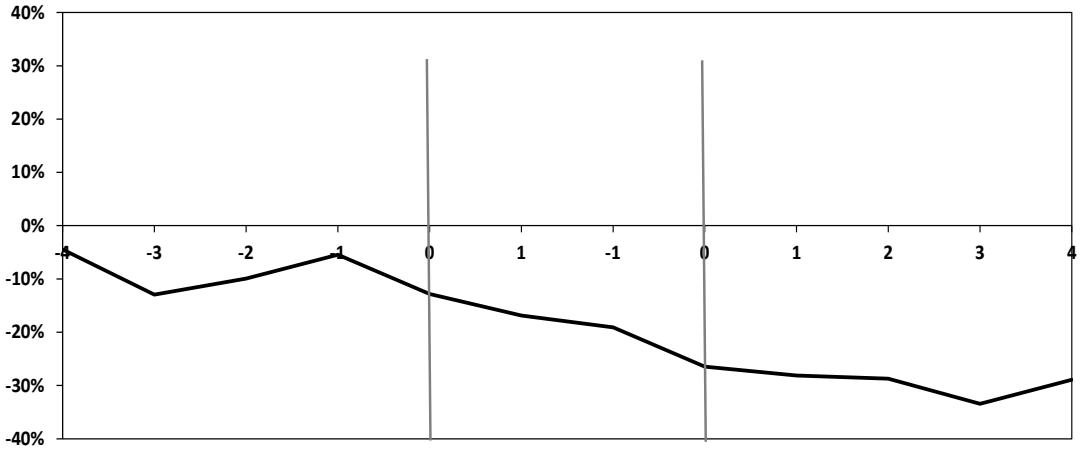


Figure 4: Cumulative daily abnormal % change in rates for 10 year government bonds around event date 16 December 08

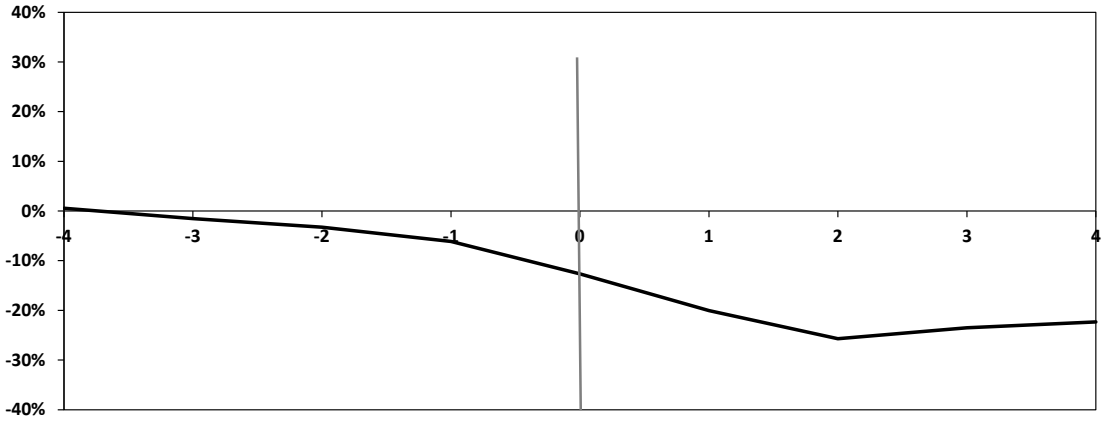


Figure 5: Cumulative daily abnormal % change rates for 10 year government bonds around event date 28 January 09

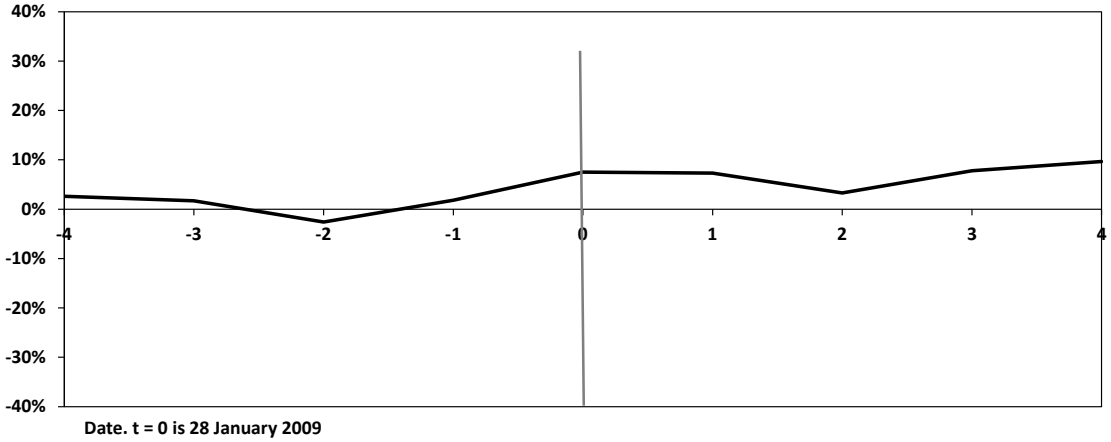
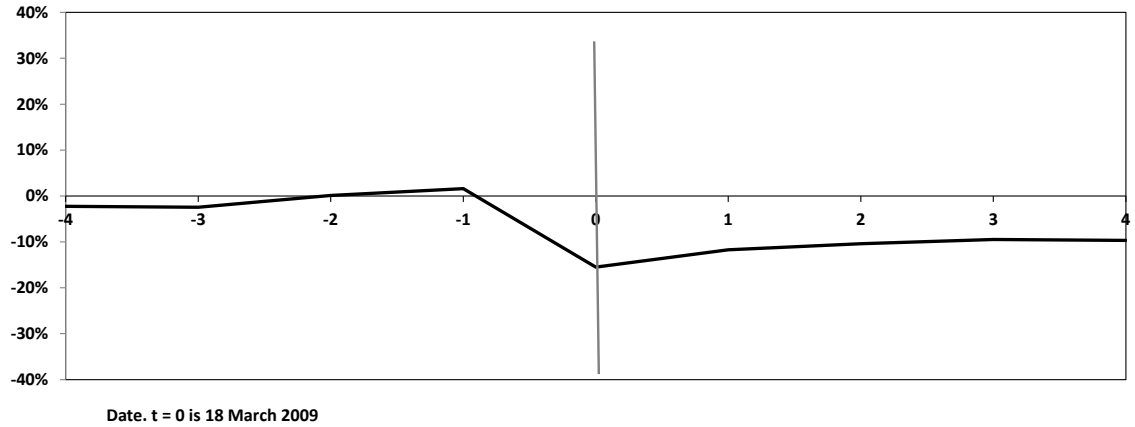


Figure 6: Cumulative daily abnormal % change on rates for 10 year government bonds, around event date 18 March 09



Four of the five announcement dates (Figures 3, 4, and 6) have cumulative abnormal returns that are somewhat like the desired pattern, a fall that persists. The exception is the QE announcement on 28 January 2009, Figure 5.

Table 6 contains statistics for the abnormal daily percentage change of the MOVE index. The average abnormal daily percentage change of the MOVE index is negative, -0.1042, and is positive for all 39 event days, 0.5358%. This is consistent with KVJ's result using another volatility index, BBOX.

Table 6: Statistics for daily abnormal percentage change of interest rate volatility, MOVE index

Statistic	Event days	Announcement Date
Observations	39	5
Mean	0.5358%	-0.1042%
Median	0.6248%	0.2509%
Max	10.7945%	9.6785%
Min	-11.5284%	-8.5595%
Standard deviation	5.0895%	6.6006%

Conclusion

This research reviewed and critiqued two studies that used the event study method to measure the impact of QE announcements or events on interest rates. Alternative event study procedures were used to calculate daily abnormal percentage changes of the interest rate on 10 year U.S. government bonds and the interest rate volatility, MOVE index. The results are consistent with the results of the GRRS and KVJ studies. However, other economic or financial news on this day may have had an impact on interest rates. The KVJ paper indicates the drop in interest rates took place within a short time period during the day. For instance, on 01 December 2008, most of the fall in interest rates occurred just before 2:00 p.m. Eastern Time. We are in the process of obtaining intraday stock market, crude oil, and exchange rate data. The intraday pattern for these variables will be compared to the intraday patter of interest rates.

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The Demand for Treasury Securities at Auction

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Abstract

This study empirically analyzes the demand for Treasury securities at auctions over the period October 1998 through July 2010 from the perspective of bid composition and the influence of demand at auction in the secondary market. The results show that the demand at auction, measured by bid dispersion, is positively related to bid-to-cover ratio but negatively associated with the percentage of accepted competitive bids as well as the percentage of noncompetitive bids. Post-auction returns are positively related to demand at auction. The findings suggest the existence of arbitrage opportunities resulting from the price discrepancy between the auction and the secondary market when the demand for Treasuries is high.

Introduction

Since October 1998, the US Treasury has switched to uniform price auctions in order to more efficiently market new Treasury security issues. Under this system, all securities are awarded at the market clearing price. Prior to the implementation of this uniform price auction system, the Treasury adopted multiple price-discriminatory auctions, in which bidders would pay the price they bid and the reported yield was the weighted average of all accepted yields. Under this prior pricing mechanism, the "winners' curse" could (easily) occur, in that successful bidders needed to pay the actual price at bid, which could very well be higher than the market consensus. Presumably, with the current uniform price system, the fear of the "winner's curse" can be substantially reduced, leading to more aggressive bidding (Malvey and Archibald, 1998; Chatterjea and Jarrow,1998; Cammack, 1991).

Rising confidence among investors would likely increase the demand for Treasury securities and subsequently eventually affect the secondary market for those Treasury issues. Two issues arise. First, how might biddings at auction reflect demand for Treasury securities? Second, how might demand at auction influence the secondary market? We investigate these issues in the present study. A sound understanding of these issues can potentially not only help investors to establish proper trading strategies but also help policy makers to better understand the auction mechanism. The published research related to these topics still limited since existing studies mainly focus on the effectiveness of the uniform price system from the perspective of market efficiency and the revenues generated for the Treasury (Bikhchandani et al., 2000; Chatterjea and Jarrow, 1998; Godbout et al., 2002; Goldreich, 2007; Malvey and Archibald, 1998).

From Treasury Direct, a proprietary Treasury book entry system introduced in 1986 for the purpose of accommodating those retail investors that typically purchase securities in the primary market and hold them until maturity, we collected relevant auction data, such as aggregated tendered bid, the accepted yields, the clearing yield and price, and so forth. We find evidence that bidders prefer submitting competitive bids with lower yields over submitting noncompetitive bids because such a strategy helps to increase the likelihood of success in obtaining Treasury securities. The demand at auction decreases with the percentage of accepted competitive bids out of total competitive bids ("competitive acceptance ratio", hereafter) as well as the percentage of noncompetitive bids out of total tendered bids except those in FIMA account ("noncompetitive total ratio", hereafter). However, the demand at auction increases with the ratio of total accepted bids out of total tendered bids ("bid-to-cover ratio", hereafter). Those ratios can be used to proxy for demand at auction. We also find that the post-auction rate of return increases with demand at auction. Such findings suggest of price discrepancy between the auction and the secondary markets and thus imply the existence of arbitrage opportunities.

The remainder of the study is organized as follows: first, the analysis reviews the literature; next, it analyzes the relation between demand at auction and the various types of bids; subsequently, the study discusses the association between the post-auction return and demand at auction; and the final section provides the overall summary and conclusions.

Literature Review

The uniform price format replaced the multiple price-discriminatory system beginning with the October 1998 Treasury securities auction. Theoretically, such a price-format change can lead to more aggressive bidding in that fear of the winner's curse is reduced under the uniform pricing system. Moreover, more bidders would presumably participate due to the simpler bidding procedure under the uniform price auction (Nyborg and Strebulaev, 2004; Nyborg and Sundaresan, 1995; Malvey and Archibald, 1998). Chatterjea and Jarrow (1998) introduce a game theoretic equilibrium model for the U.S. Treasury

securities auctions. They demonstrate that with uniform price format, the prisoner's dilemma encourages aggressive bidding, resulting in alleviation of the winners' curse. Sundaresan (2009) finds that the uniform price auction system has higher bid cover ratio and a higher dispersion of winning bids, implying increased revenues for the Treasury and a lowering of the cost of public debt issuance.

With the uniform price system, competitive bids are accepted in order of increasing yields until the offering amount is fully covered. Further, all successful bidders pay the same price, which is computed from the highest accepted yield. Although anyone may submit competitive bids, the competitive bidding is dominated by the primary dealers. By contrast, noncompetitive bidders are mainly individual investors. They submit sealed bids specifying quantity only and always win at a discount rate equal to the high yield of the competitive bids (Bikhchandani et al., 2000).

Although competitive bidders just need to specify a minimum yield at which the participant is willing to buy a specified quantity, if the auction ends at a higher yield, the bidder can receive full benefits of buying at that higher yield (Garbade and Ingber, 2005; Nyborg and Sundaresan, 1995). However, there are risks involved and the procedures can be dangerous in that once the bidding yields stay above the clearing rates, the competitive bids are voided. Naturally a question arises: why do investors submit competitive bids rather than noncompetitive bids, when there are no price discrepancies between the two types of bids? The main reason is that with competitive bids, investors can be influential of the awarding yields. First of all, informed investors, such as sellers of the forward contract in the when-issued market, can take charge of the auction by entering their demand schedules based on private information. Even in cases of failing the auctions, they can still purchase Treasury securities in the secondary market or in the repo market, to fulfill obligations, i.e., executing the forward contract. With noncompetitive bids, rather than playing a leading role in the auction, those informed traders would be dominated by other participants. Secondly, submitting competitive bids is an effective approach to control the possible yields. This is especially important to speculators, since the final yields are more important than the amounts won at the auction (Fleming, 2007).In sum, competitive bidders must juxtapose the risk of unsuccessful bids with the reward of receiving better yields for successful bids.

To use competitive bids effectively, bidders can submit bids with low yields in order to win the auction with confidence. Otherwise, investors must face certain risk by submitting bids with high yields for a better price. Thus, when the market is competitive, i.e., shares provided from the auction are far fewer than the amount needed, bidders are expected to submit more low bids than usual, resulting in the distribution of bids skewed to the left. In other words, the dispersion of bids on the higher yield side tends to be narrower in the competitive market than in an easy market. Thereby, bid dispersion on the high yield side can be viewed as a proxy for the demand of Treasury securities at auction (Goldreich, 2007). A lower dispersion indicates of a greater demand.

Meanwhile, demand at auction can affect the post-auction secondary market as well as the when-issued market, both of which are integral parts of the entire auction process. Das and Sundaram (1996) demonstrate in a theoretical framework that without the secondary market, the winner's curse can be reduced, leading to more aggressive bidding and greater revenues for the Treasury. The presence of the secondary market merely intensifies this effect because it becomes less costly for the buyers to submit high bids. For instance, unsuccessful bidders with short position can fill orders with the close substitute securities in the secondary market prior to the issuance of the new securities to winners at auction. When-issued market is another avenue to purchase securities prior to the issuance of the new securities (Mercer et al. (2011), and Nandi (1997)).On the other hand, primary dealers generally buy large quantities of securities at auction and then sell them in the secondary market. Some of those securities are sold after a security is issued and others are sold before issuance in the when-issued market (Fleming, 2007). Greater buying pressures from failed bidders in the auction are more likely to drive up prices and thereby drive down yields after the auction. This outcome is consistent with Chatterjea and Jarrow (1998)'s prediction of a price bubble after the auction of U.S. Treasury securities based on a game theoretic equilibrium model. Thus, when demand at auction is high, a condition suggestive of a higher level of unfilled bids, the price in the secondary market could also be increasing and there would seem to exist arbitrage opportunities.

Furthermore, a higher bid-to-cover ratio indicates greater demand at auction and thus implies a higher return in the secondary market. Hence, bid-to-cover ratio is expected to be positively related to post auction returns. However, only unfilled orders from the auction are important. When there is a high noncompetitive total ratio or a high competitive acceptance rate, the percentage of unfilled orders tends to be low. Thus, we hypothesize that post-auction returns are negatively related to noncompetitive total ratio as well as competitive acceptance rate. Of note, lower dispersion of yields can hint of greater possibility of collusion or market manipulation (Bikhchandani et al., 2000; Chatterjea and Jarrow, 1998; Klemperer, 2002).

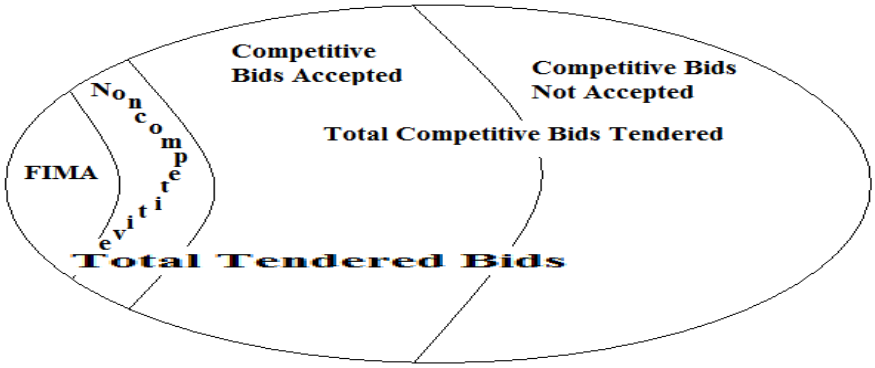
Bid Composition and Demand at Auction

In this study, we investigate the demand for Treasury securities at auction and its influence on the secondary market over the period from October 1998 through July 2010. In October 1998, the U.S. Treasury launched a uniform price auction

system for new issues of Treasury securities, under which, all Treasury securities are awarded at the same finalized market clearing rate (Garbade and Ingber, 2005). The announcement and results of each auction are provided in the Treasury Direct website. We combine all the Treasury securities into one file. The final dataset has a total of 1,927 observations for the study period.

As discussed in Section Two, bidders can submit either noncompetitive bids or competitive bids (yields) in pursuit of obtaining the security purchase they are seeking. Bikhchandani et al. (2000) find that primary dealers are more informed and thus tend to submit competitive bids, whereas individual investors are uninformed and typically submit noncompetitive bids. Indeed, primary dealers not only have information about the prices of the when-issued contracts which is available to all investors as well as to the financial press, but also maintain the demand schedules for his customers, such as pension funds and other institutional investors. However, due to data availability, we cannot divide bidders into these groups but instead investigate bidding strategies on an aggregated level. In specific, we examine how the noncompetitive total ratio and competitive acceptance ratio change in the sample period and then study their impact on demand at auction. Competitive acceptance ratio measures the percentage of competitive bids that are accepted. It equals to the number of accepted competitive bids over total competitive bids. Noncompetitive total ratio equals to the number of noncompetitive bids over total tendered bids excluding Foreign and International Monetary Authority (FIMA) account. FIMA is mainly the account for foreign governments and therefore is excluded in this study. FIMA bids are noncompetitive in nature. An example of the auction results is shown in the Appendix. Figure 1 shows the relations among noncompetitive bids, accepted competitive bids, competitive bids tendered, FIMA, and total bids tendered. Of note, total bids tendered are the sum of FIMA bids, noncompetitive bids and total competitive bids. The bid-to-cover ratio is calculated by dividing the sum of FIMA bids, noncompetitive bids and accepted competitive bids by total tendered bids.

Figure 1: Type of Bids for Treasury Securities



To secure bids, investors can choose between noncompetitive bids and low yield competitive bids. Figure 2 and Figure 3 show the means of the noncompetitive total ratios, competitive acceptance ratios, and total acceptance ratios by year and by security type, respectively. Total acceptance ratio measures the percentage of tendered bids that are accepted, excluding FIMA bids. It is similar to the bid-to-cover ratio, except for the FIMA bids.

Total acceptance ratio = total accepted bids / total tendered bids excluding FIMA bids
= (accepted competitive bids + noncompetitive bids) / (total competitive bids+ noncompetitive bids) (1)

Clearly, less than 50% of bids are accepted, with the peak of approximately 50% appearing in 2001 and with two year Treasury notes. Interestingly, the acceptance rate has fallen consistently since 2003. In 2010, less than 30% of total tendered bids were accepted. Furthermore, the majority of investors submit competitive bids. The average noncompetitive total ratio is consistently less than 5%, suggesting that over 95% of bids are competitive. This ratio also falls each year reaching its low in 2010, which suggests that noncompetitive bids may be passive as investors increasingly use competitive bids to manage yields. Among the total competitive bids, the relatively high acceptance rates occur in 2003 and 2008. After 2008 rates decline. Figures 2 and 3 show that while a higher percentage of competitive bids have been submitted in recent years fewer have been filled. This finding suggests that auctions for Treasury securities have become more intensified during recent years.

As discussed in Section Two, the demand at auction can be proxied by bid dispersion on the high yield side. In specific, when bid dispersion is lower, demand at auction tends to be higher and thereby fewer competitive bids are expected to be filled. Thus, competitive acceptance ratio, the measure of the percentage of winning competitive bids out of total competitive bids tendered, is expected to be negatively (positively) related to the demand at auction (bid dispersion). Likewise, the noncompetitive total ratio, which shows the percentage of noncompetitive bids out of total bids except the FIMA accounts, is

hypothesized to be positively associated with bid dispersion. Bid-to-cover ratio is the ratio of aggregate bids to supply and captures the extent of competition in the auction. We thereby hypothesize that demand at auction (bid dispersion) is positively (negatively) related to bid-to-cover ratio.

Figure 2: Profile of Means of Bid Composition Ratios by Year

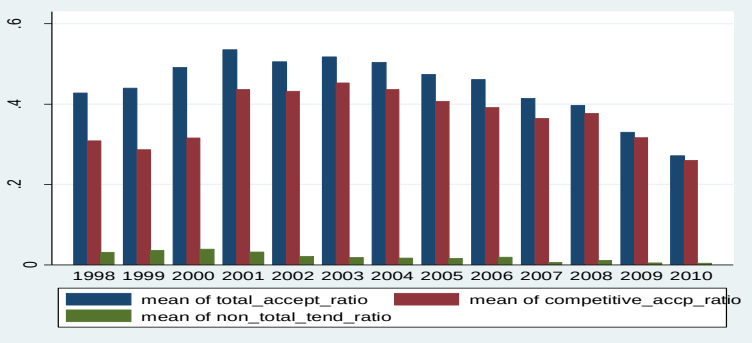
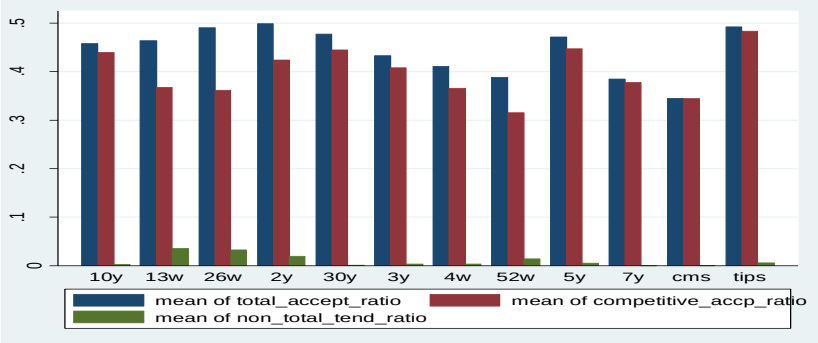


Figure 3: Profile of Bid Composition Ratios by Security Type



The hypotheses are summarized as follows.

H_1: Demand at auction (bid dispersion) decreases (increases) with the percentage of competitive bids that are accepted out of total submitted competitive bids.

H_2: Demand at auction (bid dispersion) decreases (increases) with the percentage of noncompetitive bids out of total submitted bids except the FIMA account.

H_3: Demand at auction (bid dispersion) increases (decreases) with bid-to-cover ratio.

Koesrindartoto (2004) demonstrates in theoretical terms how to auction Treasury securities and discusses associated factors including participants' learning process, market structure, the volatility of the secondary market, and relative capacity. Malvey and Archibald (1998) argue that in addition to auction techniques, economic outlook and expectations regarding movements of interest rates tend to affect auction results. Hence, to reflect economic circumstances, we include in our analysis the AAA investment grade bond spread, measured by the difference between the AAA corporate bond yield and the spot Treasury bond yield. The higher this spread is, the weaker the economy is considered to be. When economy is expected to deteriorate, money tends to fly to perceived higher quality opportunities, resulting in the present context in higher demand for Treasury securities. Gilchrist and Zakrajsek (2011) find that when there is a rise in the excess bond premium during a financial downturn, the risk bearing capacity of the financial market tends to become less effective, leading to a contraction in the supply of credit and consequently to economic deterioration. Therefore, we expect demand at auction (bid dispersion) to be positively (negatively) related to investment grade bond spread (or risk premium).

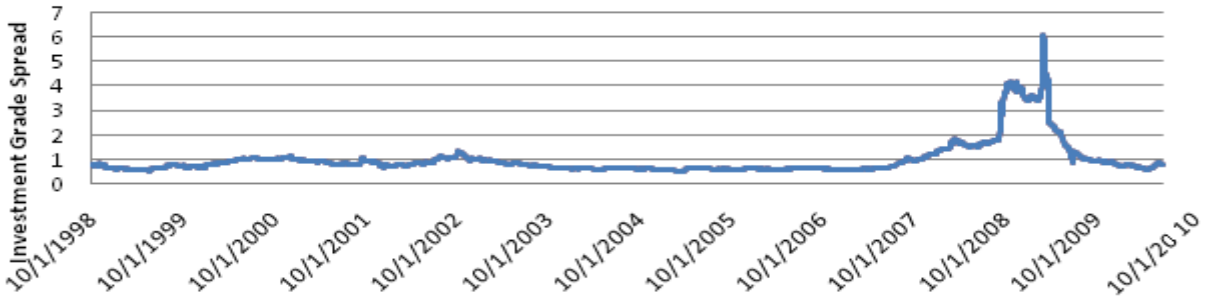
Figure 4 displays the investment grade bond spread. The data is available on FRED provided by Merrill Lynch.

As expected, the investment grade bond spread is relatively stable until late 2007. During the financial crisis period, it rose sharply. Next, we empirically test these hypotheses.

Goldreich (2007) measures bid dispersion as the difference in yield space between the marginal winning bid and the median bid. He argues that a wide dispersion could result from disagreement among bidders about the value of securities. Godbout et al. (2002) measure bid dispersion as 100*(high yield – low yield) / low yield. They investigate the auction of Treasury securities in Canada where a multiple price system still dominates. They explain that high levels of auction bid

dispersion are because of uncertainty in the financial markets, unexpected monetary policy intervention, and manipulation of the market by some participants.

Figure 4: Investment Grade Bond Spread from October 1998 to October 2010



Following Goldreich (2007), we measure bid dispersion by taking the differences between the high yield and the median yield. In specific, high and median are the accepted yields of the 100th percentile and the 50th percentile of the bids, respectively. High yield is thereby the final rewarding rate.

Bid dispersion = high yield - median yield
= highest accepted yields accepted yields 50th percentile. (2)

In this study, rather than emphasizing macroeconomic factors, we focus on three bidding ratios: the competitive acceptance ratio, the noncompetitive total ratio, and the bid-to-cover ratio. We also control for the economic environment or risk, as measured by the investment grade bond spread at the date that the auction results are announced. In addition, we take the log of bid dispersion, competitive acceptance ratio, and noncompetitive total ratio, since the values of those variables lie between 0 and 1.

We use the following fixed-effects models to test the association between bid dispersion and types of bids.

$$\text{Bid dispersion} = \alpha + \beta_1 * \text{Competitive Acceptance Ratio} + \beta_2 * \text{Noncompetitive Total Ratio} + \beta_3 * \text{Investment Grade Bond Spread} + \sum_{i=1}^{10} \beta i * Treasury\ Type i + \sum_{i=1}^{12} \beta i * Year i + \varepsilon \quad (3)$$

$$\text{Bid dispersion} = \alpha + \beta_3 * \text{Bid-to-Cover} + \beta_4 * \text{Investment Grade Bond Spread} + \sum_{i=1}^{10} \beta i * Treasury\ Type\ i + \sum_{i=1}^{12} \beta i * Year i + \varepsilon \quad (4)$$

The correlations of the bid composition variables are reported in Table 1.

Table 1: Correlations of the Bid Composition Variables

Variables	***Competitive Ratio***	***Non-Competitive Ratio***	***Bid to cover ratio***	***Investment Grade Bond Spread***
Competitive Ratio	1.0000			
Non-Competitive Ratio	0.0196	1.0000		
Bid to Cover Ratio	-0.9679***	-0.1482***	1.0000	
Investment Grade Bond Spread	0.0009	-0.1872***	0.0013	1.0000

*** indicates statistical significance at 1% level.

Of note, the bid to cover ratio is highly negatively correlated with the competitive ratio.

The estimation results are reported in Table 2.

The results show that bid dispersion, the proxy for auction demand, increases with both competitive acceptance ratio and noncompetitive total ratio, at the 1% statistical significance level. Moreover, the coefficient of bid-to-cover ratio is negative and significant as expected. The results are consistent with the hypotheses. The results further demonstrate that when the spread between investment grade bonds and Treasury bonds increases, bid dispersion decreases, whereas demand at auction increases. In sum, the results are basically supportive of our hypotheses, suggesting that lower percentages of accepted

competitive bids and noncompetitive bids tend to reflect higher demand for Treasuries at auction. Higher bid-to-cover ratio is associated with greater demand at auction as well.

Table 2: Regression Results to Test the Demand for Treasury Securities at Auction from the Perspective of Bid Composition

	Model 1		***Model 2***		***Model 3***		***Model 4***	
Variables	***Coefficient***	***T stat***	***Coefficient***	***T stat***	***Coefficient***	***T stat***	***Coefficient***	***T stat***
Competitive ratio_log	0.7048***	8.70			0.6986***	9.09		
Noncompetitive ratio_log	0.0671***	3.57					0.0817***	4.28
Bid cover ratio			-0.2464***	-8.57				
Investment Bond Spread	-0.0659**	-2.39	-0.6208**	-2.22	-0.0571**	-2.06	-0.0358	-1.28
Four week bill	-0.0589	-0.45	-0.0091	-0.07	0.0066	0.05	-0.3699**	-2.89
Thirteen week bill	-0.0972	-0.67	0.0856	0.68	0.1372	1.08	-0.4035***	-2.82
Twenty six week bill	-0.3757**	-2.55	-0.1942	-1.49	-0.1457	-1.11	-0.7294***	-5.05
Fifty two week bill	-0.3833**	-2.39	-0.2749	-1.75	-0.2465	-1.57	-0.6201***	-3.85
Two year notes	-0.2585*	-1.80	-0.0953	-0.71	-0.0760	-0.57	-0.4504***	-3.11
Three year notes	-0.2622	-1.59	-0.2110	-1.28	-0.1895	-1.15	-0.4045**	-2.42
Five year notes	-0.1637	-1.18	-0.0826	-0.60	-0.0803	-0.58	-0.2951**	-2.09
Seven year bond	0.0269	0.13	-0.0286	-0.14	0.0116	0.06	0.0083	0.04
Ten year bond	-0.1993	-1.41	-0.1457	-1.03	-0.1428	-1.01	-0.3325**	-2.33
CMS	0.1637	1.12	-0.0713	-0.54	-0.0844	-0.64	-0.0420	-0.28
Year 1999	-0.4409***	-3.31	-0.4568***	-3.40	-0.4467***	-3.33	-0.4952***	-3.66
Year 2000	-0.0420	-0.32	-0.0558	-0.41	-0.0354	-0.26	-0.04362	-0.32
Year 2001	0.2411*	1.79	0.2370	1.75	0.2062	1.52	0.5186***	3.88
Year 2002	-0.0304	-0.22	-0.0191	-0.14	-0.0607	-0.45	0.2595*	1.93
Year 2003	-0.0043	-0.03	0.0166	0.12	-0.0359	-0.26	0.3132**	2.34
Year 2004	0.1804	1.33	0.1591	1.18	0.1141	0.84	0.4756***	3.55
Year 2005	0.0554	0.40	0.0800	0.58	0.0534	0.39	0.2806**	2.04
Year 2006	0.2865**	2.12	0.2940**	2.16	0.2770**	2.04	0.4786***	3.52
Year 2007	0.2560*	1.80	0.2731*	1.93	0.2472*	1.75	0.3607**	2.50
Year 2008	0.4827***	3.53	0.4915***	3.56	0.4617**	3.35	0.5934***	4.28
Year 2009	0.3479***	2.57	0.3173**	2.32	0.2730**	2.01	0.3163**	2.29
Year 2010	0.3039**	2.22	0.2429*	1.78	0.1769	1.31	0.2040	1.47
Intercept	0.4342**	1.99	-0.0450	-0.24	-0.0144	-0.08	-0.1053	-0.49
R^2	19.67%		18.11%		18.48%		16.47%	
Adjusted R^2	18.61%		17.12%		17.49%		15.42%	
F value	18.62***		18.29***		18.73***		15.63***	
Number of observations	1,927		1,927		1,927		1,927	

***, ** and * represent 1%, 5% and 10% statistical significance level, respectively.

Post-auction Returns of Treasury Securities

Investors can trade Treasury securities in three essential markets: the when-issued market for forward trading of Treasury securities, the auction market, and the secondary market. Immediately following the announcement of a forthcoming auction, market participants start trading the new security on a when-issued basis. This market enables participants to hold contracts for the purchase and sale of a new security prior to the issuance of the security and thereby works as a path to reduce price uncertainty (Garbade and Ingberm, 2005; Goldreich, 2007). The when-issued market, the auction and the secondary market constitute the entire auction process for Treasury securities.

Here, we focus on the price changes in the same day in the secondary market after the releasing of the auction results. Secondary market participants are often divided into two parts: the sell side and the buy side. The primary securities dealers constitute the sell side, while the diverse group of final users of Treasury bonds constitutes the buy side. The buy side

includes those who use Treasuries for speculating as well as for hedging purposes, such as commercial and investment banks, insurance companies and pension funds.

When demand at auction is high, failed bidders can have their orders filled with a close substitute securities in the secondary market on the same day which would presumably generate positive aftermarket returns. Thus, post-auction returns in the same day are expected to be positively related to demand at auction. Of note, lower bid dispersion indicates of higher demand at auction.

H_4: When demand at auction is higher, the same day post-auction returns increase.

As shown in Section Three, bid composition is associated with demand at auction. This raises an interesting question with respect to the relation of post-auction return and bid composition. We use the daily yields of Treasury securities from the US Treasury website. The Treasury securities in the secondary market are close substitutes of the Treasury securities being auctioned. They were originally issued with a longer time until maturity than the current issue but now have the same time remaining until maturity as the security currently being issued. This type of security would not be a perfect substitute because it may have different coupon rates. Further, since it is an off-the-run security, it is less liquid than the on-the-run security. Nevertheless, we exclude TIPs, CMS, and thirty year bonds, because the close substitutes do not exist. Our final dataset includes a total of 1,362 observations, covering the period from October 1998 to July 2010.

Post-auction return in the same day is measured as the difference between the awarding yield at auction, the highest accepted yields, and the final yield in the same day in the secondary market (Nyborg and Sundaresan, 1995; Cammack, 1991).Of note, the new securities are expected to be delivered at the issuing date which is several days after the announcement of the auction results.

Post-auction return = highest accepted yields at auction - yield in secondary market same day

Figure 5 and Figure 6report the profiles of the post-auction returns in the same day by type of Treasury securities and by years, respectively.

Figure 5: Medians of the Post-auction Return on the Same Day by Type of Treasury Security

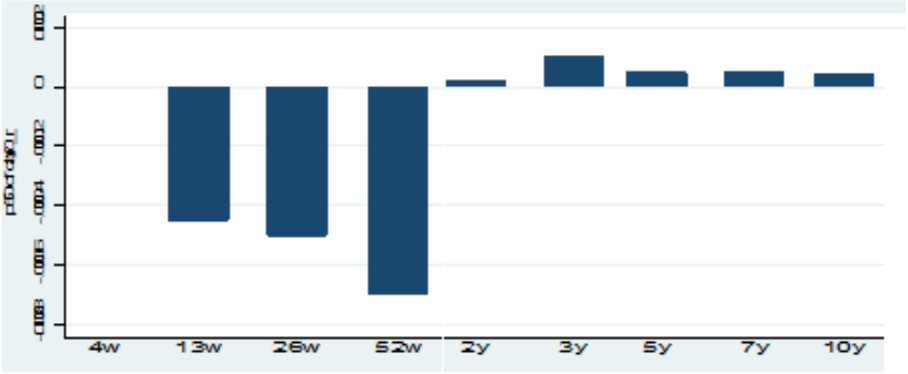


Figure 6: Medians of the Post-auction Return on the Same Day by Year

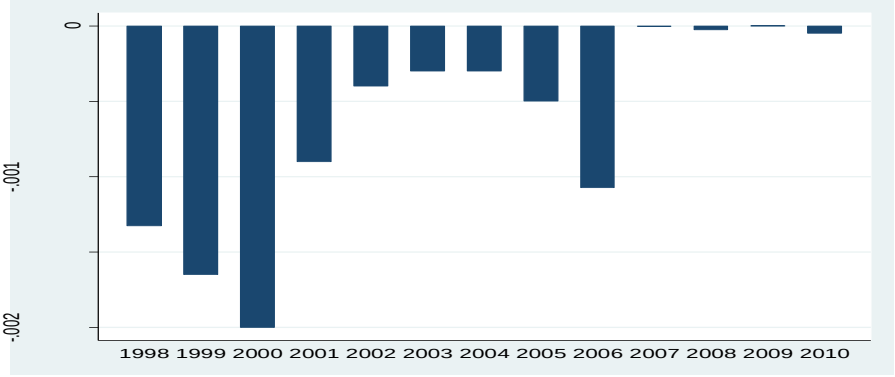


Figure 6 shows clear variation of post-auction returns by year, with the peak and the bottom appearing in 2009 and in 2000, respectively. Similarly, there are variations of post-auction returns by security type. The median returns for Treasury bills are much less than those with longer terms. Thus, it would be helpful to consider the effects of year and type. Of note, as shown in the above Figures, the median post auction returns are in general negative. This is not consistent with Chatterjea

and Jarrow (1998)'s theoretical predication of a price bubble after the auction. The regression analysis provided below further investigates the post auction returns from the perspective of demand at auction.

As discussed in Section Two, we expect post-auction returns in the same day to be positively (negatively) related to demand at auction (bid dispersion). Further, we hypothesize that post-auction returns are positively (negatively) related to bid-to-cover ratio (competitive acceptance ratio as well as noncompetitive total ratio). Of note, we control for economic environment or risk by investment grade bond spread. To test those hypotheses, we use the following fixed-effects model.

$$\text{Post-auction return} = \alpha + \beta_1 * \text{bid dispersion} + \beta_2 * \text{Investment Grade Bond Spread} + \sum_{i=1}^{7} \beta i * TreasuryTypei + \sum_{i=1}^{13} \beta i * yeari + \varepsilon \quad (5)$$

$$\text{Post-auction return} = \alpha + \beta_1 * \text{Bid Dispersion} + \beta_2 * \text{Competitive Acceptance Ratio} + \beta_3 * \text{Noncompetitive Total ratio} + \beta_4 * \text{Investment Grade Bond Spread} + \sum_{i=1}^{7} \beta i * Treasury\ Typei + \sum_{i=1}^{13} \beta i * Yeari + \varepsilon \quad (6)$$

$$\text{Post-auction return} = \alpha + \beta_1 * \text{bid dispersion} + \beta_2 * \text{bid cover ratio} + \beta_4 * \text{Investment Grade Bond Spread} + \sum_{i=1}^{7} \beta i * TreasuryTypei + \sum_{i=1}^{13} \beta i * yeari + \varepsilon \quad (7)$$

Of note, in the above models, we take the log of the ratios except for bid-to-cover ratio, which is always greater than one. The estimation results with respect to post-auction returns are provided in Table 3.

Table 3: Regression Results Regarding Same Day Post-auction Returns after Auction

	Model 1		***Model 2***		***Model 3***	
Variables	***Coefficient***	***T stat***	***Coefficient***	***T stat***	***Coefficient***	***T stat***
Bid dispersion (log)	-0.0001***	-2.83	-0.0001***	-4.21	-0.0001***	-3.84
Competitive ratio (log)			0.0005***	5.85		
Noncompetitive ratio (log)			0.0001***	2.57		
Bid-to-cover ratio					-0.0001***	-3.93
Investment Bond Spread	0.00004	1.48	0.0001**	2.22	0.00003	1.27
Thirteen week bill	-0.0003**	-2.49	-0.0005**	-3.04	-0.0003*	-1.96
Twenty six week bill	-0.0006***	-4.65	-0.0008***	-4.46	-0.0005***	-3.90
Fifty two week bill	-0.0010***	-6.54	-0.0009***	-6.61	-0.0009***	-6.04
Two year notes	0.0004***	2.76	0.0002	1.05	0.0004	3.13
Three year notes	0.0002	1.28	0.0001	0.78	0.0002	1.58
Five year notes	0.0003**	2.07	0.0002	1.37	0.0003**	2.40
Ten year bond	0.0003	0.98	0.0002	1.16	0.0002	1.32
Year 1999	-0.0005***	-4.83	-0.0005***	-4.89	-0.0005***	-4.68
Year 2000	-0.0010***	-9.15	-0.0010***	-9.89	-0.0010***	-9.30
Year 2001	0.0002**	1.97	0.00002	0.18	0.0001	0.74
Year 2002	0.0007***	6.44	0.0005***	4.43	0.0005***	4.88
Year 2003	0.0008***	7.28	0.0005***	5.09	0.0006***	5.51
Year 2004	0.0007***	6.44	0.0005***	4.50	0.0005***	4.79
Year 2005	0.0004***	3.29	0.0002**	2.08	0.0003**	2.23
Year 2006	0.0001	0.42	-0.0001	-0.65	-0.00005	-0.43
Year 2007	0.0004***	3.09	0.0004***	2.88	0.0004***	2.77
Year 2008	0.0010***	8.28	0.0010***	8.36	0.0009***	8.03
Year 2009	0.0009***	7.95	0.0010***	8.47	0.0009***	8.26
Year 2010	0.0010***	8.92	0.0012***	9.95	0.0010***	9.57
Intercept	-0.0014***	-5.07	-0.0007**	-2.05	-0.0013***	-4.90
F value	133.11***		136.75***		129.12***	
R^2	67.58%		70.16%		69.95%	
Adjusted R^2	67.07%		69.64%		67.42%	
No. of observations	1,362		1,362		1,362	

***, ** and * represent 1%, 5% and 10% significance level, respectively.

The first model tests the association of demand at auction, proxied by bid dispersion, and post-auction returns. The coefficient of bid dispersion is negative and statistically significant. This is consistent with our expectation, which states that when bid dispersion is lower, indicating of higher demand at auction, post-auction returns in the same day tend to be higher. The second model tests the determinants of the post auction returns from the perspective of bid compositions, including competitive acceptance ratio and noncompetitive total ratio. The coefficients for competitive acceptance ratio and noncompetitive total ratio are both positive and statistically significant at 1% level. However, this is not in supportive of our hypothesis. Lastly, the third model includes variables of both bid dispersion and bid composition. The coefficient of the bid-to-cover ratio is negative and statistically significant at 1% level. This is inconsistent with our hypothesis, which stating that when bid-to-cover ratio is higher, more bids are left unfilled and those unsuccessful bidders might rush to the secondary market to purchase Treasury securities. The above inconsistence with expectations could be due to the influence of the when-issued market, from which investors can still purchase and sell forward contracts of Treasury securities before the actual issuance of the securities after auction (Pichler and Stomper, 2009; Bikhchandani et al. ,2000; Fleming, 2007).

In sum, we *do* find evidence regarding the positive relation between post-auction returns and demand at auction as proxied by bid dispersion. The results tend to suggest that when demand for Treasuries at auction is higher, as observed from a lower bid dispersion, investors tend to pay higher prices to purchase the Treasury securities in the secondary market than at auction.

Conclusion

In this study, we analyze the demand for Treasury securities at auctions from October 1998 to July 2010. During this period, the US Treasury adopted the uniform price auction system. With the new auction mechanism, revenues for Treasury are expected to increase and "winner's curse" are supposed to be eliminated. We investigate such demand from the perspective of types of bids submitted and the influence of demand at auction in the secondary market. So far as we know, this topic is still new in the literature.

We estimate the fixed-effects models and find evidence that the demand at auction, measured by bid dispersion, are positively related to bid-to-cover ratio and are negatively associated with competitive acceptance ratio as well as noncompetitive total ratio. We further find that the post-auction returns are positively related to the demand at auction proxied by bid dispersion.

Lastly, the findings suggest of arbitrage opportunities from the price discrepancy between the auction and the secondary market when demand is high. However, the securities traded in the secondary market right after the auctions are off-the-run which are generally less liquid than their on-the-run counterparts. Thus, the price discrepancy could be just the liquidity premium. The findings suggest that failed bidders buy Treasury securities from the secondary market to fill their orders. Of note, unsuccessful bidders can also purchase securities from the when-issued market, by trading in the forward Treasury market prior to the issuance of Treasury securities from auction.

Future studies can endeavor to extend Chatterjea and Jarrow (1998) and apply game theory to explore the optimal bidding strategies at auction. Another avenue for future research can focus on the information integration, especially on how information spreads among the three essential markets: the when-issued market, the auction and the secondary market.

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Appendix

An Example of Treasury Security Auction Results

Department of the Treasury • Bureau of the Public Debt • Washington, DC 20239
TREASURY SECURITY AUCTION RESULTS
BUREAU OF THE PUBLIC DEBT - WASHINGTON DC
FOR IMMEDIATE RELEASE CONTACT: Office of Financing
February 11, 2003 202-691-3550

RESULTS OF TREASURY'S AUCTION OF 5-YEAR NOTES

Interest Rate: 3%	Issue Date: February 18, 2003
Series: E-2008	Dated Date: February 15, 2003
CUSIP No: 912828AT7	Maturity Date: February 15, 2008
High Yield: 3.029%	Price: 99.866

All noncompetitive and successful competitive bidders were awarded securities at the high yield. Tenders at the high yield were allotted 71.96%. All tenders at lower yields were accepted in full.
Accrued interest of $ 0.24862 per $1,000 must be paid for the period from February 15, 2003 to February 18, 2003.
AMOUNTS TENDERED AND ACCEPTED (in thousands)

Tender Type	Tendered Accepted	Accepted
Competitive	$ 33,895,105	$ 23,732,654
Noncompetitive	237,378	237,378
FIMA (noncompetitive)	30,000	30,000
SUBTOTAL	34,162,483	24,000,032 1/
Federal Reserve	3,483,950	3,483,950
TOTAL	$ 37,646,433	$ 27,483,982

Median yield 2.980%: 50% of the amount of accepted competitive tenders was tendered at or below that rate. Low yield 2.900%: 5% of the amount of accepted competitive tenders was tendered at or below that rate.
Bid-to-Cover Ratio = 34,162,483 / 24,000,032 = 1.42
1/ Awards to TREASURY DIRECT = $145,222,000

Intra-Industry Trade in South America: An Empirical Test of the Linder Hypothesis

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Abstract

Linder's 'demand side' explanation of international intra-industry trade asserts that similarity of demand structures between two countries leads to increasing trade intensity. The notion of "preference" associated with demand structure is expanded beyond its usual conception as a derivative of income and tested empirically. Intensity of intra-industry trade among eight large South American economies is found to vary according to the degree of similarity between countries in consumer preferences as these are reflected in cultural indicators including ethnicity, language, and cultural orientation. The study augments income-based determinants with cultural demand characteristics to explain bilateral intra-industry trade patterns of differentiated, manufactured goods in South America.

Introduction

The Linder hypothesis contends that international intra-industry trade varies with level of income and preference: "The more similar the demand structure of the two countries the more intensive potentially is the trade between these two countries" (Linder, 1961, p. 94). The hypothesis implies that income uniquely defines preference which determines level of intra-industry trade. Previous studies invariably assume that income is the sole determinant of preference and that only changes in income produce changes in preference. The present study investigates the effect of differences in culture on intra-industry trade independent of the effect of differences in income. Intensity of intra-industry trade among eight large South American economies (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, and Venezuela) is expected to vary according to the degree of similarity between countries in their preferences as these are reflected in cultural indicators including ethnicity, language, religion, and individualism/collectivism orientation. The study augments income-based determinants with specifically-defined cultural demand characteristics to explain bilateral intra-industry trade patterns of differentiated, manufactured goods in South America. Knowledge of the determinants and parameters governing regional trade can inform trade and industrial policymakers and may be applied by business interests for pursuing strategies to increase gains from regional trade in South America.

A brief profile of South American regional trade and income levels precedes a literature review of studies concerning intra-industry trade, over-lapping demand structures, and the relationship of cultural and preference. The conjecture regarding the effect of over-lapping or shared demand characteristics (the Linder hypothesis) motivates an empirical analysis of intra-industry trade patterns in the domain of South American intra-regional trade. Development and test of an econometric model using regression analysis techniques comprises the methodological approach. Techniques for measuring intra-industry trade intensity and demand characteristics are discussed prior to presenting results, implications of the findings, and conclusions.

South American Regional Trade

Eight large South American economies (referred to henceforth as SA8) engaged in a total of $920 billion (b) in regional trade from 2000 to 2010 averaging approximately $84b per year. SA8 trade volume in 2000 was $55b, declined to $25b 2003, and then rose in successive increments to $141b in 2009 before dropping off to $111b in 2010. Intra-regional trade volumes in manufactured goods are roughly an order of magnitude less than overall trade with the rest of the world. Chile's regional imports far exceeded those of other SA8 countries whose import volumes appear relatively static. Note that some data values are missing for Ecuador, Peru, and Venezuela for the period 2000-2003. Exports from Brazil and Argentina to regional trade partners far exceeded those of their peers indicating a lack of homogeneity in export trends in SA8 countries. Fullerton, Sawyer, and Sprinkle (2011, p. 12) find "a fair degree of regional heterogeneity" in levels of intra- industry trade in Latin America and the Caribbean for most of the ten product categories assessed, but there is a dearth of scholarship concerning determinants of intra-industry trade among the SA8 economies. Per capita gross development product (GDP), income distribution, and population of SA8 countries for 2010 are shown in Table1. The average per capita GDP across the SA8 countries is $9,692 with a standard deviation of $3,279 and a range of $10,010. The average Gini for the SA8 countries is 52.56 with a standard deviation of 3.83 and a range of 10.00. The correlation of per capita GDP and Gini is -0.67, of per capita GDP and population, 0.12, and of Gini and population, -0.36. Table 1 illustrates the gradient of per capita GDP from Argentina's $14,362 to Bolivia's $4352, the range of Gini values from Colombia's higher level of inequality (58.8) to

Argentina's lower level (48.8), and the population of Brazil (over 203 million), which is a factor of twenty times the population of Bolivia (approximately 10 million).

Table 1: SA8 GDP PC, Gini, and Population 2010 (World Bank databank, 2011)

Country	GDP PC (USD)	Gini	Population
Argentina	14362	48.80	41769726
Chile	13595	52.00	16888760
Venezuela	10805	49.50	27635743
Brazil	10055	49.30	203429770
Peru	8558	50.50	29248943
Colombia	8487	58.80	44725543
Ecuador	7324	54.40	15007343
Bolivia	4352	57.20	10118683
Mean	9692	52.56	48603064
SD	3279	3.82	63766054

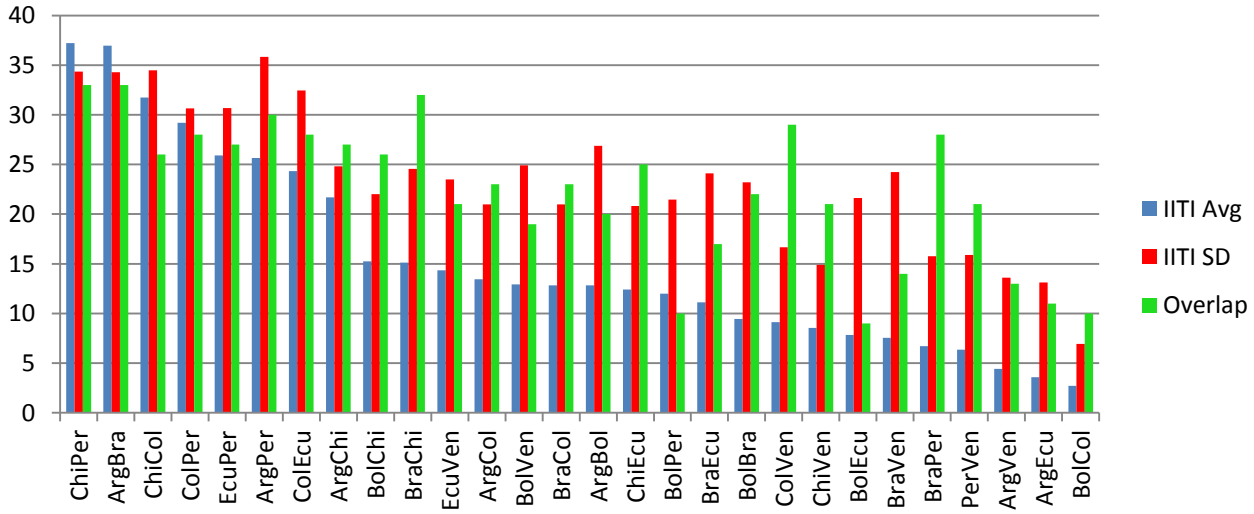
Intra-Industry Trade

Intra-industry trade is defined as "international trade that occurs when a country exports and imports goods within the same industry or product group" (Sawyer and Sprinkle, 2006, p. 500). Most intra-industry trade occurs in goods that are differentiated horizontally (similar in kind and similarly priced) or vertically (quite different in type and price). Intra-industry trade (IIT) intensity, measured by an index developed by Grubel and Lloyd (1975), is calculated by the formula in equation 1 where X is total exports, M is total imports, and the vertical bars indicate the absolute value of the difference of X and M.

$$\text{IIT index} = 1 - | X - M | / (X + M) \qquad (1)$$

The Grubel-Lloyd index ranges from 0 (no intra-industry trade) to 1 (all trade is exclusively intra-industry). Fullerton, Sawyer, and Sprinkle (2011) describe levels of intra-industry trade in Latin America and the Caribbean providing data for research on trading patterns not previously studied at the industry level. These authors collate 2003 intra-industry trade data for the ten major Standard International Trade Classification (SITC) segments. These segments are 0 – Food and live animals, 1 – Beverages and tobacco, 2 – Crude materials, 3 – Mineral fuels, lubricants, 4 – Animal and vegetable oils, fats, and waxes, 5 – Chemicals, 6 – Manufactured goods, 7 – Machinery and transport equipment, 8 – Miscellaneous manufactured articles, and 9 – Commodities and transactions not classified elsewhere in the SITC. The average IIT index for trade in manufactured goods across SA8 countries in 2010 is 0.154 (standard deviation of 0.26), but ranges across product categories from 0 to nearly 1 (Figure 1). Trade overlap occurs in every trading dyad (the rightmost vertical bars in Figure 1)

Figure 1: Intra-industry trade index statistics and number of mutual trade categories for trading dyads.



ranging from 10 out of 37 product categories (Bolivia-Colombia) to 33 of out 37 product categories (Chile-Peru, and Argentina-Brazil). The Chile-Peru dyad, countries with a shared boarder and large coastlines, has the highest IIT index (0.37). The Bolivia-Colombia dyad, countries which do not share a border – the relatively poor Bolivia is also land-locked – has the lowest IIT index (0.027). Sawyer and Sprinkle (2004, p. 90) report average IIT indices for groups of developing countries that range from 0.034 to 0.139 in 1970 and from .0285 to 0.512 in 2000. The low level of intra-industry trade among SA8 countries is in line with reports of *overall* (not just SA8) developing country intra-industry trade for 1970, but lags more recent values for 2000. Evidence of intra-industry trade among SA8 countries prompts questions regarding these levels of exchange. Theories concerning international trade and theories concerning preference in the context of intra-industry trade are described next and lead to a proposed model upon which claims of the Linder hypothesis are tested.

The theory of comparative advantage implies that South American countries collectively can benefit from specialization and trade (Ricardo, 1817). The Heckscher-Ohlin or factor-proportions theory asserts that initial resource endowments define a country's comparative advantage under conditions of perfect competition (Leamer, 1995), but fails to explain the occurrence of intra-industry trade. Three explanations are offered in the literature to explain IIT of differentiated, manufactured goods including scale economies, the product cycle, and overlapping demand characteristics (Sawyer and Sprinkle, 2005). Two firms in the same industry but in different countries can achieve scale economies in the production of differentiated goods (Harrigan, 1994). Intra-industry trade can also occur during certain phases of a product development cycle, particularly in the early stages for high technology goods subject to design and production stabilization requirements in the pre-standardization phase (Vernon, 1966). Linder's 'demand-side' oriented model contrasts with the 'supply-side' oriented Heckscher-Ohlin factor proportions model of international trade challenged by Leontief (1953) because of its inadequate explanation of intra-industry trade (McPherson, Redfearn, and Tieslau, 2001). The present study examines intra-industry trade from the perspective of Linder's hypothesis which is based on the notion of overlapping demand characteristics. Scale economies, product cycle, and overlapping demand may have a combinatorial impact on IIT, but the two former factors and possible interaction effects are not investigated in the present study.

The mechanism or process by which individuals and groups develop preferences regarding consumption of differentiated manufactured goods is not well-understood, but is constrained by income and is held to be associated with individual values and cultural context (de Mooij, 2011). Concisely stated, individuals from different countries have different cultures which exhibit different values. Differences in values are associated with differences in consumption preferences. Holding income constant, individuals with different preferences consume different *types* of products and, conversely, individuals with similar preferences consume similar types of products. Several studies empirically test Linder's hypothesis, but vary in the selection and definition of explanatory variables, number and type of trading partners, and measurement of intra-industry trade.

Literature Review

Intra-industry trade implies that countries import and export products manufactured in the same industry. The categorization of industries and the taxonomic classification of products provide the aggregations that are the basis for comparisons of intra-industry trade. Trade in *differentiated* products is assumed as trading partners have no economic reason for exchanging the exact same types of products (Grubel and Lloyd, 1971). The probability of intra-industry trade increases as the level of product aggregation increases due to the higher likelihood of overlap. Included, for example, in the highly aggregated "iron and steel" category of the Harmonized Tariff System classification scheme are 'pig iron' and 'stainless steel wire,' two highly differentiated products, but both manufactured in the steel industry. The Harmonized Tariff System (HTS) contains a high-level product category of 'iron and steel' which contains 29 mid-level categories and several hundred low-level, highly-disaggregated categories. The HTS document itself comprises over three thousand pages of highly granular product category classifications.

Grubel and Lloyd (1971) and Hallak (2010) warn of IIT index inflation as the level of industry aggregation increases implying a trade-off between IIT index accuracy and degree of specificity of goods in an industry aggregate category. Such inflation can accentuate the effect hypothesized by Linder. Hallak (2010) conducted an econometric study of 64 countries using the 3-digit Standard International Trade Classification (SITC) level product classification, distance (measured from capital city to capital city), border-sharing, common language, colonizer-colony relationship, preferred trade agreement, exporter GDP, and importer GDP. The study concludes that a high level of aggregation leads to aggregation bias when sampling differentiated goods to examine bilateral trade flows implying that the "Linder hypothesis [is] shown to be valid only when formulated at the sector level, after controlling for inter-sectoral determinants of trade" (p. 456).

The chief explanatory covariate of IIT according to Linder's hypothesis is income (Linder, 1961). The direct relationship between income and IIT is confirmed in several empirical studies. In a study of approximately thirty developed and developing countries, Kohlhagen (1977) concludes that two measures of income – absolute differences in per capita income and a proxy for real income attributed to Beckerman and Bacon (1966), partially explain IIT differences between trading partners. Francois and Kaplan (1996), Bohman and Nilsson (2007), and Dalgin, Mitra, and Trindade (2004) find that both per

capita income level and income distribution are important determinants of expenditures on goods that constitute intra-industry trade in differentiated manufactures. Fortune (1979) confirms the contribution of per capita income and income distribution measures for explaining IIT in a study of eight fully industrialized countries including the United States and seven European countries. McPherson, et al. (2001) find empirical support for Linder's hypothesis relating level of IIT to per capita income levels in six developing countries (Ethiopia, Kenya, Rwanda, The Sudan, and Uganda) using a panel data set. Several other empirical studies provide evidence in support of Linder's hypothesis, e.g., Sailors, Qureshi, and Cross (1973) and Greytak and McHugh (1975), but do not address the possible confounding effect of geographic proximity between trading partners.

The factors of distance and border contiguity are used in studies of international trade flows with the presumption, generally empirically founded, that bilateral propensity to trade attenuates with distance. For example, Bernasconi (2009) measures distance between country capitals, Hallak (2010) measures distance and whether or not countries share a border, whereas Carillo and Li (2002) employ a 'gravity' index as a proxy for transaction cost. These so-called 'gravity' models of trade are based on the equation for gravitational attraction used in physics to measure the force of attraction between two bodies which is a function of the ratio of the product of the masses of the bodies and the square of the distance between them multiplied by a constant, i.e., $F_g = G\, m_1 \cdot m_2/d^2$. Kennedy and McHugh (1980) formulate an "intertemporal test" by comparing changes in level of IIT with changes in income across time to "neutralize" the impact of distance. Results of the "intertemporal test," based on a correlative analysis of *total* trade (not just trade in manufactured goods) among fourteen industrialized countries (the United States and thirteen European nations), do not support Linder's hypothesis - a rare outcome in the literature.

Additional determinants of intra-industry trade have been explored in the empirical literature. Loertscher and Wolter (1980) find significant impact of several factors on level of IIT in Organization for Economic Cooperation and Development (OECD) countries although the level of explanatory power (coefficient of determination) ranged from only 7.2 to 14.7%. Significant country-specific factors include development stage differential, market size differential, distance, customs union membership, language group similarity, and border contiguity. Significant industry-specific variables include scale economies, transaction costs, level of aggregation, and product group. Ambiguous results are reported of effect on IIT of difference in cultural group, a construct the authors did not define. Aspects of culture (language and 'cultural group' in particular) are used as control variables in empirical studies of IIT, but are not focused on as explanatory variables. Empirical studies of IIT invariably use a measurement of income differential to explain differences in demand structures between countries. The concept of 'preference' as a component of demand structure is not rigorously defined in an operational sense beyond its characterization as a derivative of income. Culture affects economic outcomes by shaping values and consumer preferences which ultimately constitute an aggregate demand-shifting force hypothesized here to influence intra-industry trade intensity.

The notion of national culture is controversial despite empirical evidence that country groups differ in their values and belief systems (Hofstede, 2001). Differences in national cultures imply differences between countries in consumer markets (Samli, 1995) which are associated with unique patterns of consumer behavior. Discerning the complex mechanisms of consumer behavior and preference requires consideration of consumer attributes, mental processes, and social processes, and peculiarities of patterns of consumption in specific product domains (de Mooij, 2011). With regard to conceptualizing consumers' cultural differences, Holt (1994, p. 178) contrasts a "nomothetic, univocal, universalizing perspective of traits and values" with "cultural systems of tastes [or preferences that] are ideographic, meaning-based, and consumption-focused." The former is represented by Hofstede's four dimensions of cultural orientation (power distance, individualism/collectivism, uncertainty avoidance, and masculinity/femininity). The dimension of individualism/collectivism distinguishes social priorities for individual rights, freedoms, and personal achievement from social priorities emphasizing interpersonal relationships and collective achievement (Hofstede, 2001). In a survey study of 29 OECD and non-OECD countries, Guiso, Sapienza, and Zingales (2006) find that culture affects preferences which, in turn, impact economic outcomes. Bowles (1998) notes the possibility of multi-directional causality of culture, preference, and economic outcomes. Of particular interest in the present study are *consumption* preferences for products subject to international trade and whether or not countries with similar cultures and preferences exhibit higher levels of intra-industry trade.

Operationalizing cultural difference is problematic given culture's multi-dimensionality and the numerous ways that culture is defined and expressed. The notion of distinct national cultures amounts to "gross generalizations" since "the concept of a common culture applies to societies, not to nations" (de Mooij, 2011, p. 38). A nation-state is a political boundary delimiting a physical area or region whose inhabitants are subject to the system of government and rule of law of that jurisdiction. Cultural groups often straddle political boundaries and distinct subcultures may be found within the boundary of a sovereign state. Cultural attributes, moreover, represent nominal categories that elude neat taxonomies or concise classification schemes making quantification of "distance" between categorical variables tenuous. No nation is homogeneous in its language, religion, and ethnic make-up challenging characterization of national identity. Fearon (2003)

describes ethnic groups "in terms of a shared belief of common ancestry and/or shared culture feature" (9) and discusses the difficulties in conceptualizing and operationalizing ethnicity. Fearon's study offers a method for assessing "ethnic fractionalization" which indexes the probability that two people randomly selected from a population of individuals are members of different subgroups within the population (equation 2) where p_1, p_2,…p_n are proportionate shares of subgroups in the population (21). The resulting index ranges from 0 (complete homogeneity) to 1 (complete heterogeneity).

$$F = 1 - \sum_{i=1}^{n} p_i^2 \quad (2)$$

Empirical studies of intra-industry trade based on Linder's hypothesis invariably include some measure of income, but vary in their use and definition of other explanatory variables. In addition to overlapping demand characteristics, several other variables have been cited in the literature as potential determinants of intra-industry trade intensity including trade orientation, exchange rate (McKenzie, 1999; Thursby and Thursby, 1987), population, geography (Hoftyzer, 1975; Gwartney, Kipton, and Lawson, 2000), trade agreements (Carillo and Li, 2002), tariffs and non-tariff barriers to trade (Hartigan, 1981), product differentiation and product quality (Hallak, 2010), and a variety of "country and industry characteristics" (Balassa and Bauwens (1987). Tadesse and White (2007) show that immigrants can mitigate the effects of cultural distance on bilateral trade flows.

In sum, congruence of income and preferences between countries, which represents overlapping demand characteristics, is hypothesized in the literature to impact the intensity of intra-industry trade. The rationale for this hypothesis is founded on the idea that consumers in different countries are more likely to purchase the same quantity and type of goods if they have similar income levels (budget lines) and similar cultural heritages, i.e., they speak similar languages, hold similar religious values, are members of similar ethnic groups, and share a common cultural orientation. Domestic firms in each trading country manufacture goods to meet the needs and wants of their domestic markets, but also produce for export the same kinds of goods for foreign consumers who share demand characteristics similar to those of their domestic customers. Two propositions are put forth to test the hypothesis that overlapping demand characteristics lead individuals in each country to consume similar, but perhaps horizontally-differentiated, products. Proposition 1: The intensity of intra-industry trade between trading partner dyads varies inversely, *ceteris paribus*, with difference in levels of per capita income and income distribution. Proposition 2: The intensity of intra-industry trade between trading partner dyads varies directly, *ceteris paribus*, with level of ethnic, linguistic, and cultural orientation congruence.

Methodology

The Linder hypothesis is tested using a model relating variables representing market demand characteristics with intra-industry trade intensity between South American countries. Intra-industry trade index (IITI) is the dependent, outcome variable. Measures of income, ethnicity, language, religion, and cultural orientation are the main explanatory variables. A lagged dependent variable, the two-year prior IITI, is employed in the model to control for inertial effects. A mixed model with random and fixed effects is applied, the latter to account for the clustering of IITI observations in each of the twenty-eight trading dyads. Difference in population between trading partners controls for demographic differences and a binary variable indicating whether or not trading partners share a border controls for physical proximity. An ordinary least squares regression is conducted to obtain parameter estimates from cross-sectional intra-industry trade data for the year 2010 for each of the SA8 countries from the United Nations Conference on Trade and Development (UNCTAD) Trade Analysis Information System (TRAINS) available in the World Bank's databank database. Methods of measuring intra-industry trade, income, and other demand characteristics are discussed prior to specifying the details of the regression model.

Measuring Intra-industry Trade

The present study compares bilateral patterns of simple, non-weighted trade values of 2-digit Harmonized Tariff Schedule (HTS) codes for manufactured goods (segments 6, 7, 8, and 9) among eight South American countries (twenty-eight trading partner dyads) for the year 2010. The four HTS segments (manufactured goods, machinery and transport equipment, miscellaneous manufactured articles, and commodities and transactions not classified elsewhere in the HTS) comprise thirty-seven manufacturing product categories (see brief descriptions in Appendix). The Harmonized Tariff System segments 6, 7, 8, and 9 are equivalent to the SITC segments of the same name. Intra-industry trade (IIT) intensity is measured by an index developed by Grubel and Lloyd (1975). An IIT index is calculated for each of the thirty-seven product categories for each of the twenty-eight trading partner dyads to produce a data set of 1036 observations. More granular product disaggregation, although desirable to obviate positive bias in indicated level of IIT, is not feasible due to the lack of sufficient data at greater levels of disaggregation.

Measuring Trading Partner Demand Characteristics: Income and Preference

Demand for differentiated, manufactured goods can be characterized by level and distribution of income and by cultural proxies representing differences in preference. Each of these factors is described and methods are specified for their measurement. There exists no canonical technique for quantifying the degree of similarity or congruence between any pair of countries based on cultural characteristics, so an attempt is made to draw on the literature to formulate proxies upon which culture differences between trading partners can be assessed. Since measures of level of income and income distribution are held in the literature to impact IIT, both are included as explanatory variables. Absolute differences in level of per capita income in 2010 (*incdif*) for each trading partner dyad are calculated. Differences in level of Gini coefficient in 2010 (*ginidif*) for each trading partner dyad are also calculated. Indices of ethnic, linguistic, and cultural orientation congruence are developed to represent cultural distance between trading dyads. A novel method is devised in lieu of Fearon's (2003) fractionalization to better represent ethnic and linguistic congruence between trading partners. The sum of the product of proportions of individuals in each pair of countries that share a common feature is calculated. Proportions of one country's population that speak a particular language are summed then multiplied by the sum of proportions of the population in a trading partner country that speak similar languages. The level of language congruence (*langcon*) between any two countries is given in equation 3 where A = {set of languages spoken in country 1}, B = {set of languages spoken in country 2}, and *pl* is the proportion of the population in a country that speaks language l_i and l_j (only summed when l_i and l_j are identical languages). For example, 79% of the population of Argentina speaks Spanish, 2% speak Quechua, and 1% speak Aymara, so 82% of Argentines speak Spanish, Quechua, or Aymara. In the case of Bolivia, 35% speak Spanish, 27% speak Quechua, and 17% speak Aymara, so 79% of Bolivians speak Spanish, Quechua, or Aymara. The degree of linguistic overlap or congruence between Argentina and Bolivia is then obtained as the product of the proportions of each country that speak at least one of the common languages multiplied by a constant of 100, resulting in a value of 65.45. Linguistic congruence values range from 0 (absolutely no congruence) to 100 (perfect congruence).

$$langcon = (\Sigma\, pl_{ij} * \Sigma\, pl_{ji}) * 100;\ \forall\, l_i \in A \wedge l_j \in B \wedge i \approx j \qquad (3)$$

A similar procedure is used to calculate the level of ethnic congruence (*ethcon*) between each pair of countries in the SA8 trade region. Absolute differences are calculated between trading dyad countries on measures of the individualism-collectivism cultural orientation (*indcon*) and subtracted from 100 to yield values range from 0 (no congruence) to 100 (complete congruence). Language, ethnicity, and cultural orientation congruence measures are shown in Figure 2 and a logarithmic comparison of composite cultural congruence measures and average IIT index is shown in Figure 3 for each dyad.

Figure 2: Congruence comparison sorted by index composite

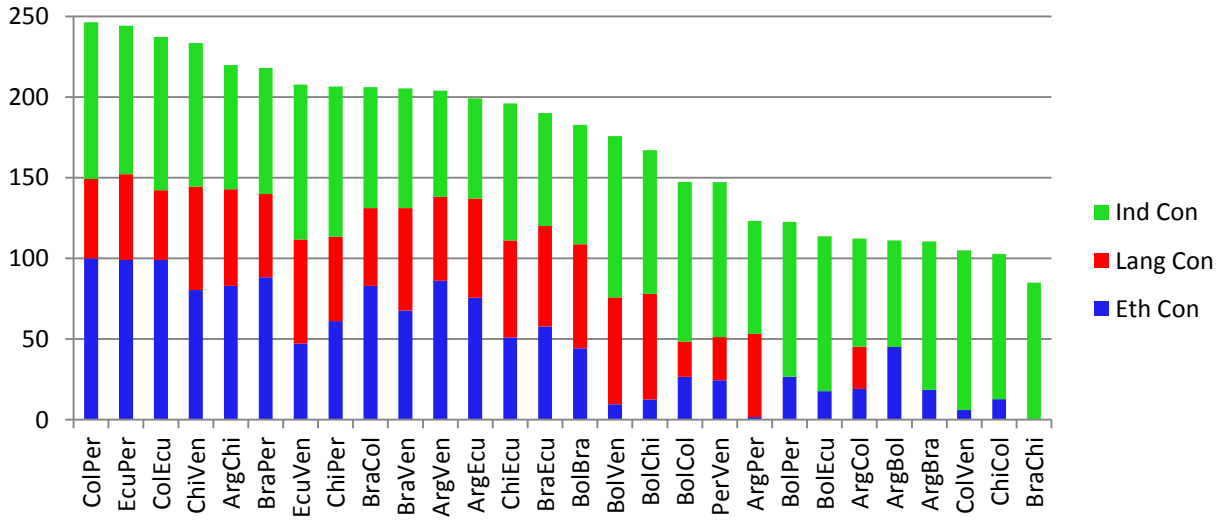
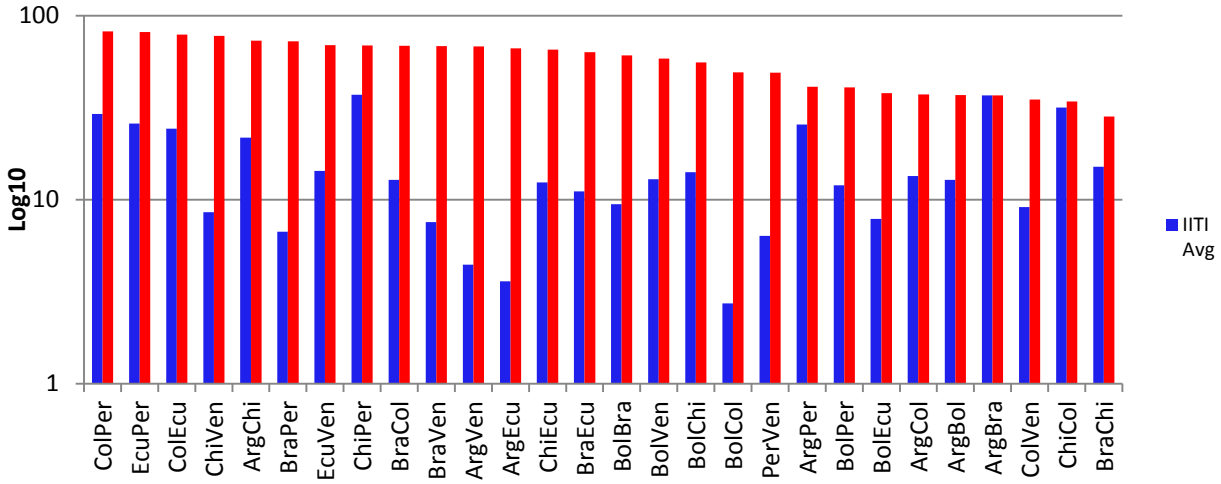


Figure 3: IIT index average and cultural congruence composite comparison



Originally, religious preference had been included as a cultural variable of interest, but was dropped from consideration due to the high level of homogeneity in this factor among the SA8 countries. The preference for Christianity was high in all countries ranging from 87.5% of the population (Chile) to 97% of the population (Ecuador). Control variables include absolute difference in population (*popdif*) between trading partners and physical proximity which is measured as a simple binary variable indicating whether or not each trading partner dyad shares a border (*border*).

Regression Model

The regression model can be stated as the relationship between IIT and the two-year lagged IIT, difference in income, difference in income distribution, congruence in ethnicity, language, and cultural orientation, population difference, and border contiguity as shown in the equation $iiti_t = \beta_0 + \alpha iiti_{t-2} + \beta_1\, incdif + \beta_2\, ginidif + \beta_3\, ethcon + \beta_4\, langcon + \beta_5\, indcon + \beta_6\, popdif + \beta_7\, border + \varepsilon$. Hypotheses concerning explanatory variables include H_1: Income difference has a negative relationship with intra-industry trade intensity, H_2: Gini difference has a negative relationship with intra-industry trade intensity, H_3: Language congruence has a positive relationship with intra-industry trade intensity, H_4: Ethnicity congruence has a positive relationship with intra-industry trade intensity, H_5: cultural orientation congruence has a positive relationship with intra-industry trade intensity, and H_6: Border sharing states have higher intra-industry trade intensity than states that do not share a border.

Results

Summary descriptive measures of variables and a variable correlation matrix are presented respectively in Table 2 and Table 3 (including intra-industry trade indices for 2008 and 2010). As remarked above, the average levels of IIT among SA8 countries for all manufactured goods in 2008 and 2010 are low (between 0.16 and 0.17), but ranges from none to the

Table 2: Summary descriptive measures for dependent and independent variables

Variable	Mean	Std Dev	Minimum	Maximum
Intra-industry trade index 2010 (*iiti10*)	0.157	0.260	0	0.998
Intra-industry trade index 2008 (*iiti08*)	0.170	0.261	0	0.998
Income difference (*incdif*)	3923	2473	70	10010
Gini Difference (*ginidif*)	4.5	3.01	0.2	10
Ethnicity Congruence (*ethcon*)	47.99	32.86	0	100
Language Congruence (*langcon*)	39.55	25.51	0	66.3
Individualism-collectivism congruence (*indcon*)	84.57	12.02	62	100

Table 3: Inter-variable correlations

	iiti10						
iiti10	-	iiti08					
iiti08	.603	-	incdif				
incdif	-.021	-.066	-	ginidif			
ginidif	-.008	.025	.226	-	ethcon		
ethcon	.087	.058	-.246	-.056	-	langcon	
langcon	.066	.062	.255	.138	.530	-	indcon
indcon	.096	.130	-.259	-.060	.352	.076	-

maximum value for some goods categories. A wide disparity in income levels exists (over $9000) between countries, but the average difference in income distribution as measured by the Gini coefficient is low. Proxies for preference (cultural indicators ethnicity, language, and orientation) vary widely and show the highest inter-correlation measures except for the correlation of intra-industry trade indices for 2008 and 2010, the latter being expected due to the effects of serial correlation.

The goodness of fit of the regression model is relatively high given values for $F(9,1026) = 68.77$ ($p < .0001$) and a coefficient of determination (R^2) of 37.6% indicating the amount of variation in intra-industry trade intensity between SA8 countries accounted for by the explanatory variables based on 1036 observations. R^2 drops to 3-4% when the lagged independent variable (*iiti08*) is excluded from the regression model. The resulting regression equation 4 (shown below with standard errors in parentheses below parameter estimates) shows a highly significant ($p < .0001$) coefficient for the lagged dependent variable $iiti_{08}$ (the second previous year's IITI).

$$iiti_{10} = \underset{(.095)}{-.247} + \underset{(.025)}{.590}\, iiti_{08} + \underset{(.000004)}{.000007}\, incdif - \underset{(.002)}{.003}\, ginidif + \underset{(.0003)}{.0009}\, ethcon + \underset{(.0007)}{.0016}\, langcon + \underset{(.0009)}{.002}\, indcon \quad (4)$$

$$+ \underset{(2.73e\text{-}10)}{8.58e\text{-}10}\, popdif + \underset{(.016)}{.005}\, border$$

The post-estimation Breusch-Pagan test was employed to test for heteroskedasticity using the procedure outlined by Wooldridge (2009). The test yielded a chi-square ratio of 87.63 with a probability value of less than .0001 suggesting that we fail to reject a null hypothesis of homoskedasticity (constant variance) in favor of an alternative hypothesis that heteroskedasticity exists in the error term. The parameter estimate for income difference is opposite the hypothesized sign and of an extremely weak effect ($\beta = .000007$) and for Gini difference is not significant ($p = .24$). The language congruence variable is significant ($p = .016$) with a weak effect ($\beta = .0016$). Ethnicity congruence is significant ($p = .006$), but exhibited a fairly weak effect ($\beta = .0009$), and the individualism/collectivism cultural dimension index is significant ($p = .038$) but also of practically weak effect ($\beta = .0018$). The measure of country proximity, whether or not trading partners shared a border, is not significant ($p=.735$). A joint (or multiple) hypotheses test is conducted to determine if the population difference, income difference, and border variables are jointly significant. The null hypothesis (H_0) states that population difference (*popdif*), income difference (*incdif*) and border (*border*) are jointly insignificant. The equation $F = (R^2_{ur} - R^2_r)/q \div (1 - R^2_{ur})/df_{ur}$ (Woolridge, 2009, p. 15) is used to assess the change in unrestricted coefficient of determination (R^2_{ur}) and the restricted coefficient of determination (R^2_r) to determine if the three variables are jointly insignificant. The calculated value of F is 1.028 whereas the critical value for $F(4,1026)$ at the 5% level of significance is 2.37, therefore we fail to reject the null hypothesis that population difference, income difference, and border variables are jointly *insignificant* allowing the conclusion that these variables together have *no partial effect* on the intensity of intra-industry trade and may be excluded from the model with no loss of explanatory power. A regression specification error test (RESET) is conducted to assess the presence of general functional form misspecification, a possible cause of bias in estimators (Wooldridge, 2009). The null hypothesis for the RESET test is H_0: the model is correctly specified. Ramsey's omitted-variable regression specification error test (RESET) yields a value of $F(3,1023) = 1.59$ with $p = .1894$. The lack of significance of these results implies that we should fail to reject the null hypothesis that the model is correctly specified.

Discussion

One of the main tenets of Linder's hypothesis, that intra-industry trade intensity is associated with income congruence or similarity in income distribution is not supported by results of the empirical analysis of SA8 regional trade. Results

concerning the three variables hypothesized in this study to be linked with differences in preference yielded significant results, but reflect practically weak effects. The remaining discussion focuses on possible explanations for these results and for the significant, but muted, impact of language, ethnicity, and cultural orientation on intensity level of intra-industry trade.

The relatively low level of intra-industry trade among the SA8 countries may be an artifact of the level of development of these countries. Less developed countries have less mature manufacturing capabilities in general making trade in manufactures less prevalent. The probability of inflated intra-industry trade indices is high due to the relatively high level of product aggregation (again necessitated by the lack of data at greater levels of disaggregation) suggesting that even the low levels of IIT are over-stated. Explanations for the lack of higher levels of IIT include the possibility that Linder's hypothesis is invalid or that SA8 countries lack sufficient maturity in manufacturing capability to exhibit the higher levels of IIT that Linder hypothesizes. The level of SA8 IIT has increased during the period 2000 to 2010, but perhaps has not reached a sufficient volume for the effects of difference in demand characteristics between countries to become evident. More pronounced IIT levels may become apparent if types of goods traded are differentiated, for example in quality, or categorized as either a necessity good or luxury good (Dalgin, Mitra, Trindade, 2004 and Hallak, 2010). Time series data analysis of intra-industry trade measures and advances in level of industrialization may produce evidence of a positive trend in IIT commensurate with the growth in SA8 regional trade observed from 2000 through 2010. Tests of normality of data produced borderline results (somewhat positively-skewed IIT indices and tri-modal cultural factor kernel density plots) hinting at the plausibility of conducting non-parametric assessments as well.

SA8 countries may be more culturally homogenous than measured given their physical proximity, i.e, being located on the same continent, thus precluding more pronounced differences in IIT. The question of how the relationship between physical proximity and culture compares with 'historical' proximity, i.e., closeness in indigenous or colonial heritage is a valid one. Notably, only 37% of the variability in intra-industry trade levels between countries is accounted for by the explanatory and control variables included in the study. Additional explanatory variables must be considered to address the remaining 63% of unexplained variation in IIT. Such variables may include terms of trade and trade policy including free trade agreements and measures of trade openness (Edwards, 1993 and Yanikkaya, 2003), exchange rates, or improved measures of proximity. Gwartney, Skipton, and Lawson (2000) devise a measure of trading country proximity based on the distance between country capitals or other large metropolitan areas. However, for the purposes of factoring transportation costs into international trade, more salient measures may include comparisons of actual shipping costs, or other related proxies such as number and location of seaports, airports, number of connecting highways and railways, or navigable inland seaways, etc.

It is probable that urban populations are responsible for the bulk of consumption of manufactured goods. Urban populations may represent more limited heterogeneity in language, ethnicity, and other cultural factors presumed here to reflect difference in preferences. These preferences are hypothesized to affect market demand characteristics associated with level of intra-industry trade. Hence, country-wide ethnic, linguistic, and cultural orientation differences are less likely to represent demand characteristics than are the more homogeneous make-up of urban populations. Consider Peru's population approximately one-third of which resides in the capital city Lima. Lima residents do not necessarily constitute a proportional representation of the various linguistic and ethnic groups in the country and may be more similar to residents of large urban populations such as those in Sao Paulo, Brazil or Buenos Aires, Argentina. Other cultural orientation factors such as power distance, uncertainty avoidance, and masculinity-femininity as described by Hofstede (2001) may be more discerning of cultural differences between urban groups across countries.

Summary and Conclusion

Various measures of income and physical proximity are found in empirical studies to influence the degree of intra-industry trade. The concept of 'demand structure' is characterized in intra-industry trade studies strictly in terms of income or income distribution and lacks consideration of non-income driven preference as a concomitant factor in determining intra-industry trade. The present study challenges previous empirical studies in the literature which consistently employ a particularly narrow definition of demand structure using income and income derivatives as a proxy for preference. Preference is developed here as an additional determinant of IIT that does not merely proxy for income, but represents a separable determinant of IIT. Econometric measures produce some support for differences in IIT that can be attributed to differences in ethnicity, language, and cultural orientation between countries. Support for differences in IIT that can be attributed to differences in measures of income and distance between countries is not shown in the results.

Challenges to discerning determinants of IIT include operationally defining demand characteristics related to preference and culture, assessing the impact of level of development and maturity of a country's manufacturing sectors, and distinguishing and controlling for the dynamic interaction of changes in homothetic and non-homothetic preferences (Markusen, 1986), or difference among goods in income elasticity of demand as these relate to the effects of cultural factors. Follow-on studies may consider relative contribution and possibility of interaction of economies of scale, product cycle, and

overlapping demand theories in explaining intra-industry trade in differentiated, manufactured, tradable products. Future research may include comparison of cultural affinity among trading partners in other regions, for example in the European Union, the broader set of Latin American countries (including the Caribbean), and the Association of Southeast Asian Nations. One of the most salient trade policy implications is the question of whether there are 'natural' constraints in bilateral intra-industry trade due to differences in relatively invariant demand characteristics between countries. Can policy changes mitigate culturally-based differences in preferences which deter intra-industry trade between countries with different ethnic, linguistic, religious, or cultural orientation? Even after more than fifty years of study, many questions concerning intra-industry trade patterns remain unanswered suggesting fertile fields for further investigation into open questions about patterns of international trade, especially among South American countries.

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Appendix

Harmonized Tariff System 2-digit product category descriptors for segments 6, 7, 8, and 9.			
Code	Description	Code	Description
60	Knitted or crocheted fabrics	79	Ships, boats and floating structures and articles thereof
61	Apparel & clothing access, knitted or crocheted	80	Zinc and articles thereof
62	Apparel or clothing accessories not knitted/crochet	81	Other base metals; cermets; articles thereof
63	Other made up textile articles; set; worn clothing	82	Tool, implement, cutlery, spoon & fork, of base metal
64	Footwear, gaiters and the like	83	Miscellaneous articles of base metal
65	Headgear and parts thereof	84	Nuclear reactors, boilers, mchy & mech appliance
66	Umbrellas, walking-sticks, seat-sticks, whips, etc.	85	Electrical mchy equip parts thereof; sound recording
67	Prepr feathers & down,; artificial flowers; articles	86	Railw/tramw locom, rolling-stock & parts thereof
68	Art of stone, plaster, cement, asbestos, mica/sim	87	Vehicles o/t railw/tramw roll-stock, pts & access
69	Ceramic products	88	Aircraft, spacecraft, and parts thereof
70	Glass and glassware	89	Ships, boats and floating structures
71	Natural/cultured pearls, precious stones & metals	90	Optical, photo, cine, meas, checking, precision
72	Iron and steel	91	Clocks and watches and parts thereof
73	Articles of iron or steel	92	Musical instruments; parts and access of such art
74	Copper and articles thereof	93	Arms and ammunition; parts and accessories thereof
75	Nickel and articles thereof	94	Furniture; bedding, mattress, matt support, cush
76	Aluminum and articles thereof	95	Toys, games & sports requisites; parts & access
77	Reserved for future use	96	Miscellaneous manufactured articles
78	Lead and articles thereof	97	Works of art, collectors pieces and antiques

Using Blinder-Oaxaca Decomposition to Estimate the Coastal Premium for Residential Housing Prices in San Diego County

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Abstract

The authors use the Blinder-Oaxaca decomposition technique to estimate the coastal premium of single family homes in San Diego County, while controlling for other locational and structural characteristics. Focusing on housing located between one and 20 miles of the San Diego County coastline, they find that approximately 20 percent of the difference in "coastal" versus "inland" housing is "explained", leaving about 80 percent "unexplained." Using this same technique, the authors are able to determine that—going mile by mile inland from the coast—the coastal premium appears to decline monotonically for the first 15 miles but then varies beyond that point.

Introduction

In coastal cities like San Diego, California, it is well known that housing prices near the coast are often the most expensive. Neighborhoods such as La Jolla and Sunset Cliffs and small cities like Coronado, Del Mar and Solana Beach are famous, not only for their prime coastal locations but also their higher residential housing prices. While there seems to be a clear link between proximity to the Pacific coast and higher housing prices, is there a causal relationship? It is possible, for example, that housing prices in these areas are higher not because of their coastal location *per se* but because, on average, these homes have more housing amenities which buyers find valuable? Are homes closer to the coast likely to have higher square-footage, more bathrooms and bedrooms, larger lot sizes, better schools and closer commutes? A recent investigation by one of the authors (Conroy and Milosch, 2011) attempted to estimate a "coastal premium" by including a "distance from coast" variable in housing price estimations. They discovered a decline in the coastal premium for housing located from 500 feet to six miles beyond the coast.

In this current investigation, we wish to extend their analysis in two important ways. First, we wish to apply a Blinder-Oaxaca decomposition technique to test for robustness of the finding of a coastal premium. Second, since Conroy and Milosch (2011) only focused on the first six miles from the coast, we wish to include a broader geographic framework to see how the "costal premium" behaves as one moves away from the coast, holding all else equal. Specifically, what is the shape of the price-distance gradient moving beyond the first six miles from the coast? Does the curve decline monotonically? Does it asymptotically approach $0? If not, why not?

Since the Blinder-Oaxaca decomposition technique provides for the estimation of an "explained" and "unexplained" portion of a regression estimation, we model the price of a single-family residential housing unit by including traditional housing variables (square footage, number of bedrooms, number of bathrooms, etc.) on the right-hand side of the model. As such, we assume the "unexplained" portion will include the coastal premium. (One interpretation of the results is that this is an upper bound on the value of the coastal premium since this may include other factors not controlled for in the model.) Results presented here confirm the existence of a coastal premium in San Diego County and that it seems to decline monotonically for the first 15 miles moving away from the Pacific Coast. From 15 to 20 miles, the premium seems to fluctuate between $84,000 and $104,000, with a "hump" around the 17-mile mark, suggesting that other factors not controlled for in our model—such as canyon views, mountain views, mean summer temperatures, average sunshine and other microclimatic conditions, etc.—may be causing the "unexplained" portion to fluctuate. In other words, other factors (not controlled for in our model) may be crowding out the coastal premium effect beyond 15 miles from the coast. At some point, the effect presumably declines to zero, but additional data would be needed (e.g., to include data from Imperial County—the county immediately to the east of San Diego County—and even Arizona). Perhaps living within driving distance to San Diego beaches confers value, just as living within driving distance to a major metropolitan area would.

There are two separate strands of literature that are relevant to this investigation, the labor market and housing market literature. We begin by discussing the former.

Background

The Blinder-Oaxaca decomposition technique has its roots in labor economics. Building upon work by Mincer (1958; 1974) to explain variation in wages, the Blinder-Oaxaca decomposition technique was an attempt—arrived at independently by two different researchers at about the same time—to measure wage discrimination (i.e., an "earnings gap") by gender or race/ethnicity. Blinder and Oaxaca offered empirical techniques to separate out the earnings gap for blacks compared to whites (Blinder, 1973) and for women compared to men (Oaxaca, 1973) into two components—an "explained" and "unexplained" portion. The "explained" portion included standard earnings equation explanatory variables such as education, experience, experience-squared and age. What was left, the "unexplained" portion, would provide (at least an upper bound estimate for) the proportion of the wage gap due to gender or racial discrimination. Using this technique, Blinder found that 70 percent of the earnings gap for blacks and 100 percent of the gap for women was due to discrimination.

The Blinder-Oaxaca decomposition technique (as it became known) has been applied to a variety of research questions. For example, Chiswick (1988) used this technique to explain the earnings gap between racial and ethnic groups. Duncan and Sandy (2007) used the decomposition technique to explain public-private school performance gap. The technique has also been applied outside of the field of labor economics. Recently, Munn and Hussain (2010) used the Blinder-Oaxaca decomposition technique to determine differences in hunting lease rates in Mississippi. Munn and Rucker (1995) applied the technique to analyze the gaps in timber sales revenue. Cooper (2010) uses an extension of Blinder-Oaxaca technique on Southwestern U.S. stream data to estimate the impact of physical and chemical stressors on benthic community fitness. We believe this technique could also provide insight into measuring differentials in housing prices for residences located near the coast compared to inland houses. In our model, if all of the differential were "explained," then there would be no evidence for a "coastal premium." On the other hand, any "unexplained" portion could be (an upper bound for a) "coastal premium."

Research in housing markets has demonstrated that locating near natural resources can provide a positive impact on prices. For example, Mahan, Polasky and Adams (2000) found that locating near natural resources such as urban wetlands to be associated with higher housing prices. Similar findings exist for other natural resources such as forests (Tyravinen and Miettinen, 2000), lakes (Kilpatrick, Throupe, Carruthers and Krause, 2007), trails and greenbelts (Asabere and Huffman, 2009), ponds (Plattner and Campbell, 1978), green spaces (Conway et al., 2010) and open spaces (Irwin, 2002). Thus, we would expect locating near ocean beaches to provide some amenities that buyers/owners appreciate. Investigations of largely rental housing units on the Atlantic Coast have found that housing located closer to the beach (Major and Lusht, 2004), especially near wider beaches (Rinehart and Pompe, 1994), to be also associated with higher housing prices. On the Pacific Coast, Boarnet and Chalermpong's (2001) investigation of the impact of freeways on housing prices included a control for distance from the coast. Their results are suggestive that locating one mile away from the coast is associated with a $42,000 drop in average home price. As noted above, Conroy and Milosch (2011) have also found evidence for a coastal premium in San Diego County using standard hedonic regression techniques. Taken together, prior research suggests that a housing price gap in San Diego County, based on distance from the Pacific Ocean—a coastal premium—is likely to exist.

Data and Methodology

The literature in hedonic pricing models is based largely on initial work by Ridker (1967), Ridker and Henning (1967) and Rosen (1974). Since the hedonic pricing function represents actual sales data, we assume that the price represents an equilibrium of demand for and supply of single family dwellings in the region. The hedonic estimation derives from the fact that housing is a composite good; i.e., it contains a bundle of attributes. We will group these attributes into structural characteristics and spatial and neighborhood characteristics. The standard hedonic price function could be represented as:

$$P = f(\mathbf{S}, \mathbf{T}) \tag{1}$$

where P is the sale price of housing, $\boldsymbol{S}$ is a vector of structural characteristics such as the number of bedrooms, bathrooms, square footage, etc., and $\boldsymbol{T}$ is a vector of spatial and neighborhood characteristics such as school quality.

In order to estimate the Blinder-Oaxaca decomposition, we used the following:

$$\Delta P = \beta_I(X_C - X_I) + X_C(\beta_C - \beta_I), \tag{2}$$

where subscript "I" indicates inland properties and "C" coastal properties, "β" is a vector of estimated slope coefficients and "X" is a vector of variables that explain housing prices. The first term in (2) represents a movement along a price "slope" (i.e., the "explained" portion of the price differential due to different average levels of amenities) and the second term represents a shift in the slope (i.e., the "unexplained" portion). Thus, the difference in values is the sum of (a) the changes in the X's, i.e., independent variables such as lot size, bedrooms, etc. (the "explained" portion) and (b) the changes in β's, i.e., the slope coefficients for each of the variables (the "unexplained" portion).

According to Conroy and Milosch (2011), it appears that housing located within six miles of the coast is associated with higher prices, even when controlling for structural housing characteristics. However, the effect seems to drop off dramatically with distance, especially within the first mile of the coast. Thus, we choose a one-mile cut off to divide the data into "coastal" and "inland" properties. We admit that this cut off point is somewhat arbitrary, but it should provide (a) a large enough sample for the "coastal" portion while (b) still capturing the "cream" of the housing units. We use basic structural and neighborhood characteristics to estimate their effect on the sale price of residential housing in these two separate spatial categories. Following Oaxaca (1973) and Blinder (1973), any remaining difference is assumed to be (the upper bound of) the "coastal premium."

The housing sales data were obtained from DataQuick® and provided by the Burnham-Moores Center for Real Estate at the University of San Diego. The data set was reduced from an initial 16,471 observations of single family homes that were sold in San Diego County during 2006 to 9,890 due largely to omitted variables, especially for lot size, which has been shown elsewhere to be an important characteristic, and for values that were considered to be outliers for this region (e.g., sales prices below $100,000 and above $12,000,000). For a small number (less than 100 observations), the hot deck data imputation method was used to fill in missing variables (see Zajac, 2003). The data provide information on the sales price of the house, parcel number, census tract, number of bedrooms and bathrooms, year the house was built, size of the lot and size of the structure. In addition, we added the State of California academic performance index (API) for the school district of the nearest elementary school as a proxy for neighborhood school quality. We use ArcGIS software in order to measure straight-line distances from the centroid of each property to the coast and to the closest elementary school. Variables included in the right-hand side are age, age-squared, bedrooms, bathrooms, structure size, lot size (see Sirmans, MacDonald, MacPherson and Zietz, 2006). We also include the "dist_API," which is an average "Academic Performance Index" score (proxy for school quality) for the district in which the closest elementary school is located.

Results

Descriptive statistics for the sample are presented below in Table 1. The mean price of the properties sold within one mile of the coast is $1,403,528. The mean price for properties located beyond one mile is considerably lower ($647,229) while the overall average is $691,888. The average age of the structure is slightly over 37 years for the entire sample, with housing located within one mile approximately 10 years older on average. The mean structure size is approximately 1,819 square feet ("Sqftstruc") overall, with properties near the coast having about 200 more square feet than those beyond one mile. The values for average lot size ("Lotsqft") are reversed, with square footage for coastal properties averaging about 9,379 square feet and inland properties more than double that amount (near 23,000 square feet). The average number of bedrooms is 3.31 overall, with coastal properties having slightly fewer bedrooms (3.17 compared to 3.32). Inland properties average about 2.17 bathrooms per house while coastal properties average slightly more, at 2.30 per house. The average district API score is 767.84 though coastal properties have higher average API scores (775.91 vs. 767.34) suggesting coastal housing is located in slightly better school districts.

We estimate two models using the "oaxaca" command in Stata (Jann, 2008). to estimate these results. Model 1 includes Age, LotSqft, Bathrooms, Bedrooms and SqftStruc. Model 2 is a slightly enhanced model, including everything in Model 1 with the addition of age-squared and the district API score for the nearest elementary school. Results for Model 1 are included in Table 2. As noted above, regression estimations were made for houses located within one mile of the coast ("Coast") and beyond one mile of the coast ("Inland"). With one exception (LotSqft, for the Inland estimation only), all parameters are significant at the one percent level. While the coefficients for LotSqft, Bath and SqftStruct all contain the expected positive sign, those for Age and Bed are somewhat counterintuitive. The result for Age suggests that older structures are associated with higher, not the expected lower, prices. One possible explanation is that older homes are likely to have larger yards (relative to the housing footprint), since newer properties are often built out to the easement to maximize the square footage of living space (which is associated with about a $747 and $397 price per square foot for coastal and inland property, respectively). Thus, controlling for square footage of both house and property, older homes are more attractive. Another possibility is that older homes are likely to be in more established, and possibly otherwise more attractive neighborhoods. While we may expect the bedrooms coefficient to be positive, the Boarnet and Chalermpong (2001) paper also reported a negative coefficient for bedrooms. Perhaps, controlling for square footage, and lot size, buyers actually prefer open interior space to bedrooms.

Table 1: Descriptive Statistics

	Within 1 Mile	Beyond 1 Mile	Total			
Variable	**Mean**	**Mean**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Price	$1,403,528	$647,229	$691,888	$556,377	$100,000	$12,000,000
Age	46.63	36.88	37.46	15.61	1.00	98.00
Age_2	2,424.43	1,597.95	1,646.75	1,249.53	1.00	9,604.00
LotSqft	9,379	22,857	22,061	102,943	1,210	8,455,867
Bath	2.30	2.17	2.18	0.83	0.50	13.50
Bed	3.17	3.32	3.31	0.82	1.00	8.00
SqftStruc	2,012	1,807	1,819	946	336	16,281
Dist_API	775.91	767.34	767.84	57.26	653.00	939.00
Number of Obs.	584	9,306	9,890			

Table 2: Regression Results for Model 1, Separating Coastal and Inland Properties

Variable	**Coast**	**Inland**	**Average Coast**	**Average Inland**	**Bw(Xw-Xo)**	**(Bw-Bo)Xo**	**Diff in Constants**
Intercept	-818,655.9***	-154,766.5***	1.0	1.0			-663,889.4
Age	11,843.4***	4,078.5***	46.6	36.9	115,453.1	286,381.2	
LotSqft	11.3***	0.03	9,379.5	22,856.7	-151,691.1	256,522.8	
Bathrooms	176,788.9***	66,939.0***	2.3	2.2	22,270.1	238,309.1	
Bedrooms	-108,643.2***	-63,499.1***	3.2	3.3	15,847.5	-149,670.2	
SqftStruc	746.9***	396.4***	2,012.2	1,806.6	153,533.1	633,233.4	
Adj. R-Square	0.4885	0.6424					
N =	584	9306					

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

Table 3 provides the explained and unexplained portion of the regressions, both in terms of the number and percent. Based on these results, only about 20.5 percent of the difference in housing prices for coastal versus inland housing is explained using standard hedonic regression components. This leaves nearly 80 percent unexplained. Recall that Blinder found that 70 percent of the earnings gap for blacks and 100 percent of the gap for women was due to discrimination, so large percentages are not unheard of in this type of analysis. Further, the large difference in mean housing prices presented in Table 1 ($1,403,528 for coastal vs. $647,229 for inland properties) suggests a sizeable gap to overcome—only part of which is explained by typical housing amenities such as age, square footage, etc. Still, we wish to improve upon the model specification in order to ensure that this is not the reason for the large unexplained portion.

Table 3: Explained and Unexplained Sum of Coefficients for Model 1

	Explained: Sum of Coefficients of X's	**Unexplained: Sum of Coefficients of X's**	**Difference in Constants**	**Sum**
Number	155,413	1,264,776	-663,889	756,300
Percent	20.5	79.5		

In other words, perhaps this large unexplained portion of the difference in housing prices for coastal and inland properties is due to a dearth of important housing and neighborhood amenities that are omitted from the regression. Thus, we include two additional right-hand side variables, Age-2 (age-squared) to see if the "age effect" declines or increases with time, and a proxy for school quality, Dist_API, in Model 2. However, the effect of these variables seems largest on inland properties and

does not seem to have any significant effect on coastal properties (Table 4). Results presented in Table 5 (Model 2) for the overall percentage of explained and unexplained portions are very similar to those presented in Table 3 for Model 1. The proportion that is unexplained is still slightly less than 80 percent. In sum, the enhanced specification of Model 2 did not change the unexplained portion of the model.

Table 4: Regression Results for Model 2, Separating Coastal and Inland Properties

Variable	Coast	Inland	Average Coast	Average Inland	Bw (Xw-Xo)	(Bw-Bo) Xo	Diff in Constants
Intercept	-846,064.4*	-766,849.1***	1.0	1.0			-79,215.3
Age	5,427.1	80.2	46.6	36.9	52,905.1	197,203.6	
Age-2	74.3	61.1***	2,424.4	1,598.0	61,362.3	20,987.1	
LotSqft	11.2**	0.02	9,379.5	22,856.7	-150,738.9	255,219.6	
Bathrooms	177,968.7***	63,291.8***	2.3	2.2	22,418.7	248,780.9	
Bedrooms	-102,662.3*	-55,524.4***	3.2	3.3	14,975.0	-156,280.3	
SqftStruc	736.9***	375.8***	2,012.2	1,806.6	151,470.0	652,296.5	
Dist_API	187.9	887.3***	775.9	767.3	1,611.0	-536,695.4	
Adj. R-Square	0.4874	0.6539					
N =	584	9306					

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

Table 5: Explained and Unexplained Sum of Coefficients for Model 2

	Explained: Sum of Coeff of X's	Unexplained: Sum of Coeff of X's	Difference in Constants	Sum
Number	154,003.3	681,511.9	-79,215.3	756,300.0
Percent	20.4	79.6		

As with Model 1, we attempt to estimate the percent that each of the individual right-hand side variables explains in Model 2. The results presented in Table 6 indicate that both lot size (19.9%) and square footage of structure (20.0%) account for the largest portion of the explained difference between coastal and inland properties. These are followed by age-squared (8.1%) and age of the property (6.0%). Bedrooms, Bathrooms and District API account for very little of the explained portion.

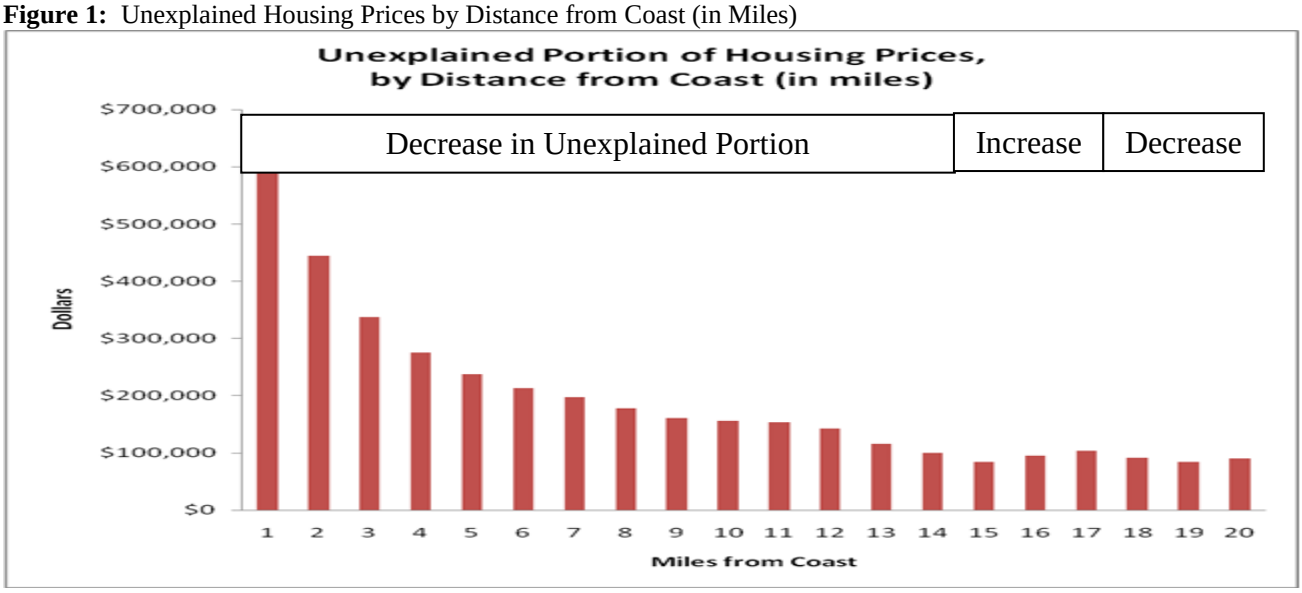
Table 6: Percent Explained by Independent Variable for Model 2

Variable	Percent Explained
Age	6.00
Age-2	8.10
LotSqft	19.90
Bathrooms	3.00
Bedrooms	2.00
SqftStruc	20.00
Dist_API	0.20

Next, we apply the results from Model 2 above to see what happens as we shift the cut-off point for "coastal" incrementally by one-mile increments, moving away from the coast. Results presented in Figure 1 demonstrate that the unexplained portion of housing prices (i.e., the upper-bound of the "coastal premium") generally declines moving sequentially mile-by-mile from the coast. This is consistent with previously-published findings (see Conroy and Milosch, 2011). However, it is interesting to note that the effect declines monotonically for the first 15 miles until the 16th mile, at which point it increases slightly. In fact, there appears to be a "hump" centered around the 17-mile mark, with the "coastal premium" generally declining after that. We believe this may be due to other "unexplained" factors which are crowding out the declining "coastal premium" effect. The geography of San Diego County is such that this "hump" may actually be

picking up positive amenities not accounted for in the model such as mountain views, canyon views and better climate (e.g., consistently sunny and mild microclimates that often persist inland, compared to foggy and misty coastal areas—with their affectionate seasonal monikers, "June-gloom" and "May-gray"). The north-south mountain range in San Diego County generally lies east of a line that lies between 10 and 20 miles from the coast, so these other effects may be increasing the average value of housing around the 17-mile mark. Since these factors are somewhat ambiguous and difficult to quantify, we leave this for future research.

Figure 1: Unexplained Housing Prices by Distance from Coast (in Miles)



Conclusions

In this investigation, we have attempted to estimate the explained and unexplained portion of housing differential between coastal and inland properties in San Diego County as a way of identifying a "coastal premium." In other words, we have attempted to identify how much of the difference in coastal and inland property housing prices is due to typical measurable amenities that are found in hedonic regressions for residential housing. Using data for 9,890 single family homes that were sold in San Diego County during 2006, results presented here are suggestive that proximity to the coast has a large, positive effect on price.

We use two different empirical models to estimate the difference in coastal versus inland properties in order to estimate the explained and unexplained portion. Both models, which include typical right-hand side hedonic housing variables such as the number of bedrooms, bathrooms, lot square footage and square footage of structure have similar results, namely that the unexplained portion of the differential is slightly under 80 percent. This provides an estimate for the coastal premium of around 80 percent. In other words, buyers are willing to pay approximately 80 percent higher prices for housing located within one mile of the coast, compared to similar inland properties. While this may seem high, the average residential housing prices on the coast are generally well in excess of $1 million (mean of $1,403,528); while those inland are roughly half of that ($647,229). Among the largest explainers of the difference were lot square footage and the square footage of structure, both with approximately 20 percent. Results presented here are suggestive that buyers are willing to pay a premium for locating near the coast—even when accounting for differential lot sizes, housing sizes, the number of bathrooms, etc.

There are several limitations to this study. First, our analysis could potentially suffer from omitted variable bias. Are there potential omitted variables whose inclusion would significantly reduce the unexplained portion and, hence, the part we are attributing to the coastal premium? For example, perhaps if we could control for other housing quality measures (crime rates, access to parks, mountain and canyon views, average lawn/garden quality, access to green space and recreation areas other than the beach, etc.), the estimated "coastal premium" would decline. As such, the 80 percent premium may be viewed as an upper bound. Second, our investigation could be sensitive to our designation of "coastal" as properties located within one mile of the coast. In the second part of this analysis, we do adjust the distance measure incrementally mile by mile and find that the effect declines monotonically for the first 15 miles. This investigation has also left unanswered what specific factors cause the coastal premium. Are buyers willing to pay more for access to the beach in order to reduce travel times for surfing, swimming, wading, etc.? How much of this is being driven by views of the ocean? We find a "hump" in the unexplained

portion of residential housing prices around the 17-mile mark. We hypothesize that this is due to other factors such as mountain views, canyon views and microclimatic conditions which are not controlled for in this analysis. We leave these matters for future investigations.

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Synergy Disclosure in the European Energy Sector

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Abstract

A substantial minority of bidding firms disclose synergy forecasts during mergers and acquisitions (M&A). We use these projections to investigate the characteristics of these synergies as well as to explore their effects on the announcement returns of bidding and target firms within the European energy sector between 1998 and 2010. We provide evidence that target and especially bidding firms experience significantly higher announcement returns owing to a synergy disclosure. Additionally our results show that synergies are driven by firm relatedness; in particular, cultural relatedness significantly increases the emerging synergy potential.

Introduction

There is no binding obligation to communicate expected synergies in a merger and acquisition (M&A) transaction. Berkovitch & Narayanan (1993) show in a cross-industrial investigation of M&A motives that synergies are the primary objective of M&A; however, the voluntary disclosure of synergy forecasts has so far hardly been explored. Voluntary disclosure studies have primarily focused on accounting related releases (see Baginski, Hassell, & Waymire, 1994; Baginski & Hassell, 1997; Bowen, Davis, & Matsumoto, 2002). Our study extends this field of research by analyzing synergy communication effects at the merger announcement on target and bidder share prices within the European energy sector. Hence, we complement the evidence on voluntary disclosure generally and synergies at the merger announcement specifically.

Another objective of our research, however, is to move beyond pure measuring and assigning profits to transactions by explaining more fundamental value creation factors. The drivers of increased announcement returns are particularly important for an M&A's value generation since these returns do not only reflect the investor's perception of the deal, but also affect the completion probability (Luo, 2005). Therefore, if the communication of synergies is an efficient tool to increase announcement returns, it can be implied that they also serve as an instrument to increase the likelihood of completion. The underlying rationale is that M&A in general are subject to a high degree of asymmetric information (Moeller, Schlingemann, & Stulz, 2007; Officer, Poulsen, & Stegemoeller, 2009). Reducing these asymmetries through a voluntary information disclosure, such as synergy forecasts, results in favorable investor reactions.

Thus far, synergy research has considered a cross-industrial perspective to infer general implications. Dutordoir, Roosenboom, and Vasconcelos (2010) demonstrate that acquiring firms in the US which disclose synergies are attributed with favorable stock price reactions and hence firms use synergy disclosure as a value signaling tool. Bernile and Bauguess (2010) also report positive stock price effects for the US owing to synergy disclosure decisions. However, since significant differences are found for varying industries, the need for a detailed industrial analysis due to varying industry characteristics arises, to which our study responds. In particular, due to idiosyncratic industry features these cross-industrial investigations have the potential to result in misleading industry level conclusions.

To address the sector specific relevance of synergy forecasts we looked for an industry which is characterized by a high ratio of voluntary disclosure and similar business models between the companies in this sector. If it is not possible to detect synergy disclosure effects in such a sector it is hard to imagine to find them at all. To further increase sample homogeneity with respect to general market implications we take a geographic focus on the European energy sector. This sector is especially relevant since its M&A rate increased significantly due to government enforced liberalization efforts: whereas the global energy-related M&A rate rose by 30% in 2004/2005, the European rate rose by 80% (Datamonitor, 2005). Moreover, the energy industry has a significant synergy potential. Bernile and Bauguess (2010) show that the synergy disclosure rate for the US energy sector is 30.7% while for all industries combined it is only 22.7%. Hence, synergies are particularly relevant for this industry and thus can be expected to exhibit a more dominant role as compared to a general industry observation. While former synergy-related studies have unanimously concentrated on the US market we address a new geographic environment: the European market. Thus, we are able to compare prior findings to a different market place perspective.

The remainder of the paper is structured as follows. Section 2 conducts a literature review of voluntary pre-merger information disclosure in general and their effect on announcement returns. Section 3 identifies the research questions, while section 4 presents the research model. Section 5 shows the announcement effects of synergy disclosure and section 6 summarizes our findings and identifies further areas of research.

M&A Announcement Effects: Literature Review

Voluntary Pre-Merger Information Disclosure

Thus far, evidence on voluntary disclosure focuses on accounting-related releases. Baginski and Hassell (1997), for instance, examined the precision of earnings forecasts while concluding that the information value of these particular forecasts increases with the number of analysts following the firm. Moreover, it is demonstrated that earnings forecasts in general have the potential to influence the share price of publicly traded firms (Baginski, Hassell, & Waymire, 1994). Other voluntary disclosure research is related to extended press releases or conference calls clarifying and elaborating on earnings announcements (see Bowen, Davis, & Matsumoto, 2002; Francis, Schipper, & Vincent, 2002; Kimbrought, 2005). All studies indicate that there is an influence on the respective response group and thereby demonstrate the effectivness of voluntary disclosure.

In the light of M&A, Lipin and Sirowner (2003) argue that the communication strategy can be the decisive factor for the success or failure of the deal. Consequently, it is especially important to provide quantitative forecasts to not only enable investors to track post-merger performance, but also to evaluate the deal. By failing to indicate vital information, uncertainties are created. If the market is aware that private information exists which, however, is not communicated, a negative content is implied. Thus, the disclosure decision can have a substantial impact on the post-announcement performance of the share price (Dye, 1985).

Disclosure behavior in takeovers differs from routine situations and more recent research is thus concerned with share price effects. Erickson and Wang (1999) as well as Louis (2002) investigate the effects of an upward manipulation of earnings announcements prior to a merger and demonstrate a positive correlation. Jo and Kim (2007) analyze the effects of the disclosure frequency in seasonal equity offerings and conclude a positive correlation with post-issue performance which hints at a reduction of information asymmetries prior to the transaction. This finding is confirmed by Lang and Lundholm (2000); however, the increase in disclosure frequency obviously created a hype and the respective stock price declined disproportionally in the post-announcement phase.

Our study differs from earlier research since the disclosures under consideration are speficially directed at an event (i.e. the M&A) and are not of a general nature such as an earnings forecast around the M&A announcement. Kimbrought and Louis (2011) have a comparable focus by investigating the effects of conference calls at merger announcements. They demonstrate that those bidders which held calls at the merger announcement disclosed a greater degree of information and emphasized forward-looking details. Managers in general, especially in stock-based transactions, have an incentive to disclose additional deal-related information since the completion of the merger is highly dependent on the post-announcement stock performance of the bidding firm. Besides that, the incentive for conference calls increases with the size and complexity of the transaction where the merger motivation as well as benefits are less clear to investors. Overall, Kimbrought and Louis (2011) demonstrate that M&A with conference calls experience higher announcement returns compared to those who fail to do so. Thus, the increased information content released to investors appears to increase the announcement returns.

Synergies as Merger Motive and Disclosure Effects

Literature has identified three main takeover drivers: synergies, agency effects, and hubris (Berkovitch & Narayanan, 1993). The hubris hypothesis initiated by Roll (1986) suggests that managers are unable to correctly value target firms and are thereby likely to overpay and destroy shareholder wealth. Hence, these takeovers are driven by the management's overconfidence in their ability to extract gains. The agency effect proposes that again through the merger it is not the shareholder's wealth that is increased, but the management's welfare. It is implied that the compensation is a function of the firm size and thus managers are likely to lower their hurdle rate to take on additional investments which increase the firm size at the expense of their shareholders (Mueller, 1969). Finally, synergies are the third objective, which result if the merging firms' resources are combined in an efficient manner that leads to economic gains. Moreover, a takeover can pursue multiple objectives; thus, these three motives are not mutually exclusive. Yet, Berkovitch & Narayanan (1993) show that the realization of synergies is the primary M&A driver. Zhang (1998) is able to confirm this general proposition for the US banking industry and further highlights the importance of synergies during takeovers.

From the shareholder's point of view, synergies during an M&A are an indicator of increased profitability of the newly formed entity which eventually increases the firm's value. Moreover, an increase in the firm value translates into the stock price of the merging firms, which should appreciate. However, the information on the merger motivation, i.e. whether synergies exist, must not be disclosed by bidders. The necessary ad-hoc information only needs to incorporate information that has the potential to influence the stock price. In the case of an M&A, it is hence sufficient to indicate the transaction

without any further details. The most frequently used vehicle to do so are press releases. Nonetheless, firms can voluntarily disclose additional information such as the motivation of the merger and, if applicable, a quantitative forecast such as a synergy estimate. It can be expected that additional pre-merger information indicating a value increase should be appreciated by the market.

Bernile and Bauguess (2010) are able to confirm this notion by collecting synergy estimates of US mergers between 1990 and 2005. They demonstrate that the market's reaction to those mergers is more favorable; in particular, the capital market's reaction of M&A with communicated synergies is higher and increases in value with higher synergies. However, the study also infers that the variation across industries is high, which requires unique industry-related studies. This proposition is underlined by Jaggi (1978). Thus, to increase the accuracy as well as expressiveness of synergy disclosure effects, the following research will focus solely on one industry: the energy industry.

Research Question

Our study firstly investigates the shareholder wealth effects of a synergy disclosure on the M&A transaction. Secondly, the characteristics of synergies within the European energy market are identified; their relative size compared to other industries as well as their value drivers are discussed. Overall, three hypotheses are proposed.

Hypothesis 1**:** *Value effects for bidding energy firms increase if a synergy forecast is disclosed at the M&A announcement.*

Many studies on wealth gains from M&A conclude that the bidding firm's stock price frequently decreases upon merger announcement (Morck, Shliefer, & Vishny, 1990; Moeller, Schlingemann, & Stulz, 2005). One of the major driving forces thereupon is asymmetric information concerning the merger rationale (Moeller, Schlingemann, & Stulz, 2007; Officer, Poulsen, & Stegemoeller, 2009). We thus expect that if bidding firms decide to communicate a synergy estimate at merger announcement, information asymmetries are reduced. Hence, if firms communicate expected synergies, investors are informed about the merger motive as well as the implied wealth gains which can serve as a value creation signal for rational market participants. An increased confidence about the profitability of the transaction can hence be implied, which should translate into the stock market's reaction. It has already been demonstrated that other elements that reduce information asymmetry, such as conference calls (Kimbrought & Louis, 2011), affect the announcement returns positively and we propose a similar effect for a synergy estimate.

Hypothesis 2**:** *Value effects for target energy firms increase if a synergy forecast is disclosed at the M&A announcement.*

Similar to *Hypothesis 1*, we also expect the abnormal returns for target firms to increase if the bidder's management discloses a synergy estimate. Following our argumentation, a reduction of information asymmetries is likely to result in favorable stock price reactions. However, in contrast to the bidding firm's announcement returns, targets are frequently subject to significant positive reactions (Andrade, Mitchell, & Stafford, 2001; Bruner, 2004). Therefore, both sets of targets (i.e. targets with and without synergy disclosure) are anticipated to have positive announcement returns, yet those transactions with a synergy disclosure are expected to realize increased ones.

Hypothesis 3**:** *The relative magnitude of the disclosed synergies correlates with the relatedness of the transaction.*

Healy, Palepu, and Ruback (1997) predict synergies to be the highest in related acquisitions which also motivates managers to use the degree of similarity as an instrument to forecast synergies (Lubatkin & Srinivasan, 1997). Therefore, we expect that if the merging entities are more alike, the magnitude of the realizable synergies increases. However, there are different sources of similarity, i.e. culture, business, or size, while the effects of each, especially in the European energy sector, are hard to predict. We expect that all of them are positively correlated to the magnitude of disclosed synergies.

Cultural relatedness is measured with a dummy variable attributing all national M&As with 0 and cross-border ones with 1. Business relatedness is identified through the firms' SIC codes, while considering firms that share an identical code to be related. Again, dummy variables are assigned; transactions with business relatedness are attributed with 0, the remainder with 1. Size relatedness is measured with the merging firms' sales at announcement. To ensure the comparability of the data set, a ratio of target sales to bidder sales is computed. We moreover controlled for the bidder and target firm size, measured with the respective market value 60 days prior to announcement, the transaction value, and year of transaction.

Sample and Experimental Design

Sample Selection

Our sample consists of all completed energy-related M&A that occurred between January 1, 1998 and December 31, 2010 in Europe; the following SIC codes are considered to identify the respective M&A: 1311, 1321, 1381, 1382, 1389, 4911, 4922, 4923, 4924, 4925, 4931, 4931, 4932, 4939, 4941, and 499A. To construct the sample, the Thomason Financial

SDC database is utilized. Minority deals are excluded, a minimum transaction value of 1 million USD has to be present, and only purely public transactions are considered, i.e. target and bidder firms have to be publicly listed. This selection allows us to capture varying wealth implications due to the synergy communication for the bidder and target. In addition, the firms had to be listed at least 220 days prior to and 20 days after the announcement to estimate wealth effects.

Table 1: Number of M&A offers by year of announcement

Year	# of Deals	# of Deals w/ Synergy Disclosure	% of Deals w/ Synergy Disclosure
1998	7	2	29%
1999	8	4	50%
2000	4	3	75%
2001	4	0	0%
2002	5	3	60%
2003	2	1	50%
2004	2	0	0%
2005	4	2	50%
2006	8	4	50%
2007	6	2	33%
2008	4	4	100%
2009	4	1	25%
2010	2	1	50%
All Years	60	27	45%

In the following process, press releases and news reports are researched at the merger announcement of all 60 deals, while recording all communicated, quantified synergy estimates. Therefore, only management estimates were considered, excluding other party estimates, for instance by analysts or journalists. Thereby, the validity as well as accuracy of the data is ensured. Table 1 shows the use of voluntary synergy communication over the research timeframe. The synergy communication frequency appears to be stable over time. We do not find any indication for changing willingness to communicate synergy forecasts during our period under consideration. For those forecasts lacking precision, the following assumptions were made:

- if a value range is provided, the midpoint is considered;
- if no range but solely a minimum value is indicated, the minimum value is considered;
- if no time frame is indicated, the synergies are expected to manifest two years after completion in accordance with the estimates of most transactions which provide a time frame.

Valuation of Synergy Forecasts

The communicated synergies are discounted to compute their present value (PV) at announcement following Kaplan and Ruback (1995), while assuming that synergies are realized in perpetuity. The PV is hence computed as follows

$$PV\ (Synergies) = \frac{S_t}{(K-I)\times(1+K)^{t-1}} \quad (1)$$

with S being the steady-state communicated synergies after the t^{th} year of completion, K the discount rate, and I the inflation rate. In line with Houston et al. (2001), communicated synergies are expected to grow at the long-term inflation rate at the time of the announcement; thus we assume zero real growth. As an inflation estimate, the European harmonized consumer price index (HICP) obtained from the European Central Bank is utilized.

For the calculation of the discount rate K we assume that the communicated synergies carry a risk similar to the bidder's equity in line with Houston et al. (2001) and Dutordoir et al. (2010). Therefore, K is calculated as

$$Discount\ Rate\ (K) = r_f + \beta \times market\ premium \quad (2)$$

with r_f being the risk-free rate and β the bidder's market beta. As the risk-free rate, the ten-year government bond of Germany is utilized at the time of the merger announcement following Heston, Rouwenhorst, and Wessels (1999) as well as Croci (2007). The beta is computed utilizing a time period of -40 to -210 trading days prior to the merger announcement and the S&P Europe 350 as the market proxy. The market premium is assumed to be 7% in compliance with prior studies on synergy effects (see Houston et al. (2001)).

Cumulative Abnormal Returns

To measure wealth implications for bidder as well as target shareholders, the event study methodology (see Fama, Fisher, Michael, & Roll, 1969) is applied, with the event being the announcement of the merger or acquisition at $t = 0$. While assuming the market model and a estimation period of -40 to -210 days prior to the announcement, the abnormal return (AR) by firm *i* on day *t* is computed by subtracting the forecasted market model based return E(R) from the actual return R by firm *i* on day *t:*

$$AR_{it} = R_{it} - E(R_{it}) \quad (3)$$

The expected return is calculated as

$$E(R_{it}) = \alpha_i + \beta_i R_{mt} \quad (4)$$

while α represents the intercept term at time *i*, β the systematic risk determiner at time *i*, and R_m the return of the market index (S&P Europe 350) at time *t*. Both α and β are calculated using an Ordinary Least Squares (OLS) regression. Stock price information is retrieved from Datastream using daily total returns (RI).

The cumulative abnormal returns (CAR) and cumulative average abnormal returns (CAAR) for different event periods $[t_1;t_2]$ are calculated as below with *N* being the number of transactions. The total event period comprises 11 trading days, with 5 days prior to the announcement and 5 after the event date $t = 0$.

$$CAR_{it} = \sum_{t=t_1}^{t_2} AR_{it} \quad (5)$$

$$CAAR_{it} = \frac{1}{N} \sum_{t=t_1}^{t_2} CAR_{it} \quad (6)$$

To test for the statistical significance of the retrieved abnormal returns our study employs three test statistics. Initially we conduct a simple parametric *t*-test. Moreover, we apply a cross-sectional test as proposed by Boehmer et al. (1991) which controls for a potentially increased standard deviation due to the combination of variance information from the event and estimation window. Furthermore, as prior research provides some evidence that non-parametric *t*-statistics are more powerful that parametric ones (e.g. Barber & Lyon, 1996), we complete our statistics with the Wilcoxon-signed rank test.

Results and Discussion

Size and Drivers of Synergy Forecasts

Overall, 45% of all European energy-related transactions communicated a synergy estimate within the period under consideration. Bernile and Bauguess (2010) conclude for a different time frame (i.e., 1990 to 2005) on the US energy market a synergy communication rate of 31%. Overall, it appears that this particular industry has a relatively high communication rate, which also made Dutordoir et al. (2010) exclude it from their cross-industry synergy research. Industry-wide they conclude that 17% of all deals communicated synergies based on 2,793 transactions in the US market between 1995 and 2008. Another study by Bernile and Bauguess (2010) using a sample of 3,935 US transactions between 1990 and 2005 conclude a synergy communication rate of 23%.

Regulated industries require multiple approval processes and hence providing a merger objective as well as rationale such as a synergy estimate is likely to decrease the complexity of the regulatory approval process. Thus, firms operating in the energy sector have an additional incentive to reduce information asymmetries besides increasing the announcement returns at the M&A. Moreover, industries with objective, measurable synergy potential such as scale and scope economies increasingly communicate synergies. Therefore, not only the energy industry has a relatively high communication rate, but

also, for instance, the chemical industry with 33%. In contrast, industries with less potential such as healthcare or durable goods have a low communication rate with 18% and 11% respectively (Bernile & Bauguess, 2010).

To enable further comparison of the synergies in the European energy industry, their present values are computed which in a second instance are scaled by the combined market capitalization of the target and bidder firm. Overall, the average (median) bidder beta of the sample is 0.77 (0.73) while the average (median) discount rate *K* is 9.57% (9.88%). Apparently, European energy firms are less sensitive than the market (i.e. S&P Europe 350) to market movements, which is suggested by the low beta. This fact is driven to a great degree by the highly regulated market environment. Most energy firms were state-run and thus were and still are subject to a stable cash flow which reduces the overall firm risk. In addition, the European energy market is characterized by an oligopolistic market structure owing to the ongoing consolidation during the 1980s which created a few large players with considerable financial strength (Bednarczyk, Schiereck, & Walter, 2010).

Scaling the transactions by the combined bidder and target market capitalization that communicate a synergy estimate results in an average (median) value of 10.11% (6.71%). Prior studies on voluntary synergy disclosure applying an identical scaling lead to similar findings: Houston et al. (2001) conclude 13.1% (9.5%) for the US banking industry, Dutordoir et al. (2010) as well as Bernile and Bauguess (2010) 11.7% (6.9%) and even 14% (7.1%) respectively for a cross-industrial analysis. However, Dutordio et al. (2010) as well as Bernile and Bauguess (2010) do not, in contrast to our study, assume synergies to grow at a long-term inflation rate. We interpret this finding in a direction that it appears that the synergy-to-market capitalization ratio within the European energy industry is below those of the cross-industrial ones of other studies. The absolute synergy figures cannot be expected to cause the low ratio since the discount rate can be expected to be lower compared to the other studies (due to the low beta) which makes the absolute synergy figures large. Therefore, with respect to the oligopolistic European energy market and its few large firms the combined market capitalization appears to be relatively high.

Finally, value drivers of synergies within the European energy market are identified regarding the third hypothesis. We expect that firm relatedness drives synergies and tests these assumptions with an OLS regression (while controlling for heteroskedasticty) and the scaled present values of disclosed synergies as the dependent variable. See Table 2 below.

Table 2: Synergy value drivers

Variables	**Synergies**
Intercept	17.493
	(1.644)
Cross Border	-0.066*
	(-1.924)
Business	0.014
	(0.426)
Relative Size	-0.063
	(-1.377)
Transaction Value	0.185
	(1.120)
Bidder Size	-0.116***
	(-4.174)
Target Size	-0.151**
	(2.721)
Year	-0.009
	(-1.631)
Adjusted R^2	0.205
N	27

T-statistics are indicated in parentheses and are robust to heteroskedasticity. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Synergies resulting from cross-border transactions are expected to be below those of national ones due to cultural discrepancies which increase the integration costs (Larsson & Finkelstein, 1999). In particular, cultural differences are likely to lead to misinterpretations of objectives as well as to interpersonal conflicts (Bruton, Oviatt, & White, 1994). In addition, Kavanagh (2002) demonstrates that most Eastern European power plants require infrastructural upgrades to respond to the most current EU norms and standards. Owing to these additional costs, the profitability of the investment for Western Europe acquirers decreases while the time to generate synergies increases. As our results in Table 2 below demonstrate, we are able

to confirm this notion for the European energy sector. Due to the dummy variable analysis, no quantitative inferences can be made; however; the significant negative sign proves that cross-border transaction are subject to lower synergy estimates.

We also expect a negative sign for the measure *business relatedness*, indicating that unrelated transactions lead to lower synergy forecasts. We argue that firms engaged in similar transaction have an increased potential to transfer knowledge or procedures. In addition, operational aspects such as the reduction of unit costs or usage of distribution channels can be utilized (Montgomery & Singh, 1987). Our evidence shows this impact with a negative slope; however, the mean differences are not statistically significant. We interpret this in a way that the business relatedness between the firms researched is naturally small since all firms are active within the same sector (i.e. energy) and thus we actually assess the effects of sub-sector relatedness. Therefore, due to no statistical significance, we can infer that the various sector characteristics within the energy industry do not affect the synergy generation as a whole.

Finally, size relatedness effects are investigated. We expect, according to Ahujy and Katila (2001), that targets and buyers of similar size are able to more efficiently integrate knowledge and other operational aspects. Thus, buyer managers can more instantly recognize redundant processes which then leads to a more instant and efficient workforce reduction resulting in increased savings, hence synergies (Krishnan, Hitt, & Park, 2007). In contrast, Seth (1990) shows that size differences lead to increased synergies, arguing that small buyers can increase their market power as well as generate economies of scale and scope by acquiring larger targets. From our size ratio (i.e. target sales to bidder sales) we can infer that an increase in target size reduces the ratio, all else equal. Hence, if the slope is negative synergies increase with a decrease in bidder size, thus bidder size is negatively correlated to synergies. However, this coefficient is not significant, most likely due to our small sample size. Thus, we cannot demonstrate that firm size relatedness influences the magnitude of disclosed synergies.

However, we are able to show that an increase in the bidder size reduces the magnitude of the communicated synergies and thus eventually reduces shareholder value creation. Larger bidders apparently generate lower efficiencies which is confirmed by previous research from Moeller, Schlingemann, and Stulz (2004). In addition, our evidence suggests that bidders apparently expect a greater synergy potential from smaller targets, most likely since they perceive to be able to explore scale and scope opportunities not already exhausted by a larger firm size.

Short-Term Stock Price Reactions Following Synergy Disclosure

As expected, bidding firms that do not communicate a synergy estimate are not able to generate positive abnormal returns in accordance with prior studies (see Morck, Shliefer, & Vishny, 1990; Moeller, Schlingemann, & Stulz, 2005). Panel B in Table 3 demonstrates negative CAARs for all event windows except for the announcement date as well as the window [0;1], yet these returns are not statistically significant. Of significance is the period [-5;5] with a negative CAAR of 2.88%.

Table 3: CAAR for bidding European energy firms

	CAAR		Boehmer Test	t-Test	Wilcoxon Test	
Event window	Mean	Median	z-score	t-value	z-score	Nobs
Panel A: Bidding firms with synergy estimate						
[-5;+5]	1,65%	2,91%	1,171	1,233	-1,538	27
[-1;+1]	2,07%	2,22%	1,898*	1,937*	-2,282**	27
[0;+0]	1,29%	1,18%	1,433	1,490	-1,682*	27
[0;+1]	1,46%	1,69%	1,640	1,570	-2,090**	27
[0;+5]	0,73%	1,26%	0,859	0,670	-0,769	27
Panel B: Bidding firms with no synergy estimate						
[-5;+5]	-2,88%	-1,34%	-2,183**	-2,381**	-1,889*	33
[-1;+1]	-0,52%	-0,38%	-0,395	-0,616	-0,393	33
[0;+0]	0,13%	0,31%	0,620	0,200	-0,935	33
[0;+1]	0,17%	0,24%	0,529	0,211	-0,673	33
[0;+5]	-1,07%	0,21%	-0,567	-1,006	-0,355	33

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

In contrast, energy firms that do communicate a synergy estimate (Panel A) are able to generate positive abnormal returns. For the five event windows during the ten days surrounding the announcement, positive abnormal returns are

observed. The highest CAAR of 2.07% comes from the window [-1;1] which is also significant. Moreover, the day of the announcement as well as its succeeding are significantly positive. For longer time frames, i.e. 10 and 20 days past the announcement, the CAARs decline, yet these are not statistically significant (not shown).

Similarly, M&A that communicate synergies also have a positive effect on target announcement returns. Table 4 demonstrates that both panels of target firms (with and without a synergy disclosure) have significant positive announcement returns.

Table 4: CAAR for target European energy firms

	CAAR		Boehmer Test	t-Test	Wilcoxon Test	
Event window	Mean	Median	z-score	t-value	z-score	Nobs
Panel A: Target firms with synergy estimate						
[-5;+5]	13,57%	10,16%	4,615***	4,345***	-3,700***	27
[-1;+1]	11,72%	7,37%	4,145***	3,926***	-3,868***	27
[0;+0]	10,50%	7,53%	5,261***	4,848***	-4,012***	27
[0;+1]	10,64%	7,48%	4,764***	4,476***	-4,012***	27
[0;+5]	9,47%	7,34%	3,741***	3,707***	-3,315***	27
Panel B: Target firms with no synergy estimate						
[-5;+5]	7,79%	3,61%	2,039**	2,735**	-2,421**	33
[-1;+1]	7,31%	4,34%	2,009**	2,847***	-2,778***	33
[0;+0]	6,19%	3,23%	1,782*	2,386**	-2,743***	33
[0;+1]	5,87%	2,29%	1,762*	2,325**	-2,153**	33
[0;+5]	5,89%	1,69%	1,715*	2,130**	-1,706*	33

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

In contrast to the bidding firms' announcement returns, we would expect target firms to have a positive CAAR regardless of a potential synergy communication. As prior research demonstrates, target firms most frequently have significant positive announcement returns (Andrade, Mitchell, & Stafford, 2001; Bruner, 2004). The CAARs for targets with no synergy communication increase shortly around the event date and reach their maximum in the event window of [-5;5] with abnormal returns of 7.79% at the 5% significance interval. During the same interval, targets with an associated synergy communication attain a CAAR of 13.57% at the 1% confidence interval.

Table 5: Synergy Disclosure Influence

Panel A: Descriptive statistics						
	Disclosure sample		**Non-disclosure sample**		**Difference**	
	Mean	Median	Mean	Median	Means	Medians
Bidder CAR [-5;5]	1.65%	2.91%	-2.88%	-1.34%	4.53%**	4.25%***
Bidder CAR [-1;1]	2.07%	2.22%	-0.52%	-0.38%	2.59%*	2.6%**
Target CAR [-5;5]	13.57%	10.16%	7.79%	3.61%	5.78%	6.55%*
Target CAR [-1;1]	11.72%	7.37%	7.31%	4.34%	4.41%	3.03%
Panel B: Regression analysis						
	Bidder CAR				**Target CAR**	
Variables	**[-5;5]**		**[-1;1]**		**[-5;5]**	**[-1;1]**
Intercept	-0.029**		-0.005		0.078***	0.073***
Synergy Disclosure	0.045**		0.026*		0.058	0.044
R^2	0.098		0.06		0.031	0.021
N	60		60		60	60

The mean (median) significance is tested with the *t*-test (Wilcoxon test). All t-statistics are robust to heteroskedasticity. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Recalling Hypothesis 1 and 2 we now intend to demonstrate that the announcement returns for synergy disclosing firms are more favorable. Table 5 above does so by comparing the mean and median difference for non-disclosing and disclosing firms as well as by an OLS regression on the CARs and a synergy disclosure dummy variable. Panel A shows that the mean and median differences for various event windows are significantly lower (except for the [-1;1] event window for target firms) for non-disclosing firms. Moreover, Panel B shows that synergy disclosure has a significant positive influence on the bidder CARs. Therefore, we are able to demonstrate while confirming hypothesis 1 that the communication of synergy estimates has a positive influence on the short-term announcement returns of bidding firms. Thus, we may also imply that quantitative synergy forecasts are an efficient instrument to decrease information asymmetries and convey a value-creating M&A transaction to rational investors. For target firms on the other hand only few evidence is retrieved to confirm hypothesis 2 and apparently the market implied value creation is mainly attributed to the bidding firm.

Finally, we investigate which merger characteristics from those transactions which disclose synergies are likely to lead to a value appreciation. Thereby, we are able to identify which aspects are perceived to create value from a market's perspective and thus also which factors the market perceives to enhance the ability to generate the communicated synergies. Table 6 below shows the OLS estimates controlling for heteroskedastisity with the bidder and target CARs for the highly significant [-1;1] event window as the dependent variable.

Table 6: Relationship between CAR and projected synergies

	(1)	**(2)**
Variables	**Bidder CAR [-1;1]**	**Target CAR [-1;1]**
Intercept	-4.959	-3.213
	(-0.941)	(-0.231)
Bidder Size	-0.032*	0.253***
	(-1.897)	(7.892)
Target Size	0.004	-0.411***
	(0.117)	(-6.225)
Relative Size	-0.055**	0.010
	(-2.303)	(0.144)
Transaction Value	-0.064	0.145
	(-1.141)	(0.560)
Cross Border	-0.023	0.067
	(-1.030)	(1.600)
Business	-0.030*	-0.013
	(-1.766)	(-0.269)
Year	0.003	0.002
	(0.955)	(0.235)
Adjusted R^2	0.097	0.097
N	27	27

T-statistics are indicated in parentheses and are robust to heteroskedasticity. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Our results indicate that the market associates fewer announcement returns for larger bidders as the bidder size correlates negatively with the bidder CARs. From this we can imply a size effect which has already been proven by Moeller, Schlingemann, and Stulz (2004). According to their research larger bidders pay an increased premium which does not reflect the actual merger gains leading to a value depreciation. According to Table 3, we can show that larger premiums are not reflected by larger synergies as these decrease with the bidder size which also further supports the notion that large premiums for these merges are not rationally justified by emerging synergies. We interpret this finding in a way that bidding managers include other aspects besides synergies within their premium calculations yet these factors are not actually value creating. Hambrick and Hayward (1997) for instance suggest these factors to be the CEO's media presence as well as a measure of the CEO's self-importance. In addition, we can also show a size effect for target firms which is however reversed. Larger bidders lead to increased target announcement returns. This finding is yet not surprising since these bidders, as has been described, pay increased premiums which create value for targets regardless of whether the premium is rationally justified.

Moreover, we find that the relative size (target-to-bidder) correlates negatively with bidding announcement returns. Thus, the larger the size difference between the two merging entities the greater the announcement returns for the bidding

firm. Therefore, relatively large bidders compared to their target are attributed with an increased ability to create value and since the subsample we research solely considers synergy-expecting M&A, we are able to conclude that the market attributes these relatively larger bidders with an increased ability to generate synergies. Interestingly, as Table 3 shows, the size relation has no influence on the magnitude of expected synergies, thus relatively large bidders cannot generate *more* synergies however their ability to implement their expected synergies is perceived to be favorable.

Finally, our results show that business unrelatedness is perceived as value destroying. The negative slope indicates that mergers between varying utility sectors are attributed with fewer announcement returns. With reference to expected synergies, we hence can infer that the market perceives their implementation to be more complex in the case of mixed utility mergers. Therefore, the likelihood of actually realizing disclosed synergies is expected to decrease if different energy sectors merge which consequently results in fewer announcement returns. As with size relatedness, the business sector does yet not show an influence upon the disclosed synergy size, hence bidding managers perceive the business sectors to not contain idiosyncratic features which have the potential to lower expected synergies.

Conclusion

We investigate synergies and their drivers in the European energy industry as well as the effects of their disclosure on the respective bidder and target announcement returns.

Our evidence suggests that synergy disclosure and size within the European energy sector significantly differs from other industries. Not only do bidder managers communicate synergies more frequently with 45% of all transactions, but also the relative size of those communicated synergies is smaller than compared to an industry average. These findings can be redirected to the unique industry structure, with the European energy sector being highly consolidated and thus characterized by an oligopolistic market structure. The investigation of synergy drivers proves that the relatedness of the M&A affects the disclosed magnitude. Especially the cultural component revealed its significance while other parameters tested (i.e. size and business) were not found to shape synergies significantly. Thus, cross-sectional transactions within the energy market between various utilities apparently do not affect the synergy potential.

The findings of the voluntary synergy disclosure on announcement returns are consistent with other studies on comparable aspects (Kimbrought, 2005). Hence, synergies serve as an instrument to reduce information asymmetries and may also be utilized as a value-signaling tool. Target and especially bidder firm announcement returns which disclosed quantitative synergy forecasts are significantly higher in contrast to firms which did not do so. Moreover, we show that the bidder size decreases the returns for synergy disclosing bidding firms while an increased size ratio has a value creating influence. The market moreover attributes higher returns for bidders which conduct a related M&A. However, the magnitude of expected synergies is not shaped by relative size and energy sector relatedness, solely the likelihood of implementing these synergies is affected thereby which results in fewer announcement returns.

A fruitful further area of research emerging from our study is an investigation of determinants of management credibility in disclosing synergy forecasts. Apparently bidding managers and the market perceive realizable synergies to a certain degree differently. Thus research upon factors which convey the market form the management's perspective would enable managers to further increase respective announcement returns. Other relevant aspects are varying market perceptions of different synergy sources, i.e. an investigation of announcement returns from communicating financial, or organizational, or revenue synergies.

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Equity Based Metrics Used to Model Financial Distress

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Abstract

We use metrics based on equity - return on equity (ROE), standard deviation of return on equity (σ_{ROE}), return on equity to volatility ratio (ROE/σ_{ROE}), and differences in rates of return on equity, for banks and enterprise sectors - to predict the emergence of financial crisis. Financial crises, like business cycles, typically are cyclical in nature, the positive and negative movements being generated by some underlying mechanism. We find that one such mechanism relates to risk transfer between financial sector and the real economy. Specifically, the asymmetry of risk distribution, between banks and non-financial entities, has, historically, preceded financial crisis.

Introduction

Banks are originating loans to finance the capital projects of companies in the real economy. The Return on Equity realized by the borrower should be very close to the return on bank capital used for funding the projects implemented by those enterprises. The funding sources, delivered by banks to finance the projects, are one of several cost components. We assume that realized rate of return on funding sources delivered by banks should be consistent with the rate of return on other tangible and financial resources used to complete the project. On average, ROE in the real sectors of the economy are approaching a certain level, which in a stable and balanced economy cannot be much lower than the bank's rate of return on capital. If this occurs we would consider this an extraordinary "gain" for the bank without justification based upon the risk and return trade-off principle.

Based on the data from financial reports, for banks and companies in the US economy, contained in the Wharton Data Base, we calculated Return on Equity (ROE), which was used to estimate three metrics: standard deviation of return on equity (σ_{ROE}), return on equity to volatility ratio (ROE/σ_{ROE}), and differences in return on equity for banks and enterprise sectors. Differences between the above mentioned metrics for banks and companies would, of course, be expected within certain boundaries. In a balanced economy however, it is unlikely that banks would realize returns significantly greater than average or companies would be charged with significantly greater risk than average in the economy. This difference measure might offer some forewarning of financial crisis. Is it possible that the greater this difference, the higher the probability of crisis? Measuring this difference in normal economic times would allow us to establish a benchmark, which can then be used as a reference to diagnose the remoteness or proximity of crisis.

The financial distress occurs when promises to creditors are broken or honored with difficulty (Brealey and Myers, 2003, pp. 124). The financial distress may involve in one time few enterprises or few financial institutions within certain economy, but it can happen that in short period of time there is a huge number of entities being financially distressed. The financial distress may lead to the bankruptcy which occurs when stockholders exercise their right to default. The right is valuable; when a firm gets into trouble, limited liability allows stockholders simply to walk away from it, leaving all it troubles to its creditors (Brealey and Myers, 2003, pp. 125). The big number of distressed companies and financial institutions can lead to financial crisis. There are internal and external reasons leading to the financial distress of the company. In this paper we will be focused on risk transfer from banks to the enterprise sector as an external source triggering the distress process on a rather high scale. Therefore banks should be interested in the proper balance between risk and return in both enterprise and financial sectors. The big difference in these measures between the financial and real economy sector can be treated as an "unfair" risk allocation resulting from an imbalance in trade-transactions between the business partners (banks and enterprises). From a macroeconomic perspective this can be observed as the process leading to financial crisis.

The main contribution of this paper to the overall research on the topic about mechanisms and early warning indicators of the financial distress and ultimately the financial crisis derives from the proposal of the metrics, which reflects a difference in the risk allocated in banking and enterprise sectors. These differences offer an indication of magnitude of financial distress resulting from risk transfer between financial and real economy sectors.

Literature Review

The problem discussed in this paper can be split into two components. The first relates to the consideration of the mechanisms and reasons of the financial crisis. The second has to do with metrics used as measures of financial distress

across the economy sectors. The financial distress around the economy sectors can rise on the intensity, and ultimately it can evolve into the crisis. The term financial crisis is applied broadly to a variety of situations in which some financial institutions or assets suddenly lose a large part of their value (Wikipedia).

The crisis can be triggered by systemic risk which is closely related to the issues of concentration ("too big to fail") and dependency ("too connected to fail"). From that point of view the crises are caused by systemic distress arriving from the structural fragility of the financial institutions framework on the market (Gramlich Dieter, Oet Mikhail V., 2011). The concept of fragile environment around the financial institutions leading to the financial crisis was developed by Minsky who identified this issue long before any serious financial crisis occurred (Minsky, H.P., 1977). The rational expectations hypothesis is no longer relevant when the information made available to the actors is incomplete. In such circumstances the interaction between banks and firms is based on using uncertain profit expectations which feed financial crisis (Parnaudeau Miia, 2011). One of the interesting concepts explaining the mechanisms and reasons of financial crisis is a Veblenian view of Minsky's financial crisis theory (Kelso Patrick R. and Duman Barry L., 2010).

There are different approaches for detection and monitoring of financial crisis. One class of methods used to monitor the financial crisis are based on a display of the correlation between the level of credit spreads and crisis cycle (Irvin W. Morgan Jr, James P. Murtagh, 2012), linkages between stock market fluctuations and business cycles (Candelona Bertrand and Metiua Norbert, 2011), estimating a stock market instability index (Dong Ha Kim, Suk Jun Lee, Kyong Joo Oh and Tae Yoon Kim, 2009), and stock market linkage between Asia and the United States (Yoshida Yushi, 2011). These methods deliver evidence about some correlation between economic variables associated with financial crisis, but do not offer measures for very early warning signals.

The next class of methods used to detect financial crisis are models indicating financial crisis based on financial market volatility. Although, they are very interesting from the technical point of view, they are not efficient in sending very early warning signals of financial crisis (Kyong Joo Oh, Tae Yoon Kim and Chiho Kim, 2006). The models, which are more efficient than the previous one, are based on "behavioral VaR" approach (Satchkov Daniel, 2011). Some examples of the application of these models show that early warning signals are received several months before crisis events. In the next sections, we propose a model which uses metrics capable of predicting the financial crisis long in advance.

Mechanisms of Financial Cycles

Financial stress is inextricably linked to economic development and economic cycles, which are further characterized by different levels of "financial tension." This financial stress has significant impact on the economy and would be useful to define the financial cycles and monitor their characteristics against such economic cycles. Hyman Minsky proposed an explanation of one mechanism leading to financial crisis, which then triggers economic crisis. His research attempted to provide an understanding and explanation of the characteristics of financial crises. Others have proposed the analysis of financial cycles using certain economic indicators (i.e. downturns and upturns in credit, house prices, and equity prices) (Claessens Stijn, M. Kose M. Ayhan, Terrones Marco E., 2011). Economic cycles are measured as change in GDP over time. We express the financial cycle's curves as differences: between the returns on equity, between the volatilities, and between the returns on equity to volatility ratios, as measured for financial and enterprise sectors. The combination of the three curves derived from above mentioned measures will be referred to as the Pattern of Financial Cycles (*PFC*). The analysis of the financial cycle helps to recognize the intensity of financial stress and proximity to the financial crisis, which may be understood as the most severe phase of the financial cycle.

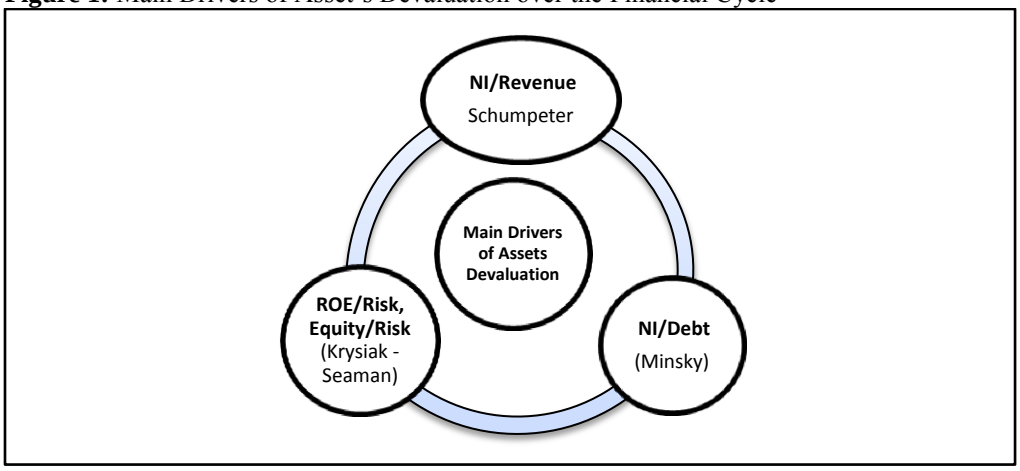
Modeling the financial cycle will take on greater importance over time, as there is rapid increase in the nominal value of the assets in banking sector due to increasing populations, increasing debt per capita, and increasing states' budget debts in nominal terms - all in relation to the GDP. The value of debt to the GDP in US, including social responsibility approaches 100%. In many European countries this ratio greatly exceeds 100% and it is very likely that it will increase further. For these reasons, there is a need for methods and measures to evaluate the intensity of crisis. We would like contribute to this discussion here, identifying crisis intensity rather than simply a prediction of future crisis.

Business cycles are for the economy like "blood circulation" for the body. The circular renewal of different resources and assets, being at the disposal of the business entities, is like the exchange of carbon dioxide for oxygen in the lungs. Old assets becoming useless or non-productive lose value and must be replaced. Stable business cycles, however, do not result in large shocks for the economy such as happens during financial crisis. Regular business cycles are ruled by a mechanism Schumpeter called "creative destruction". This means, that previously used assets must be replaced them with new ones, which are more productive and capable of sustaining continued growth. This creative destruction leads to devaluation of certain assets, resulting in losses for businesses and, often, the economy as a whole. The value of such losses may be attributed to the cost of doing business and are not quite as severe as are those losses incurred during a crisis. In contrast to the ordinary recession phase, in a typical business cycle, the crisis carries substantial financial impact for individual enterprises and the economy as a whole. The last crisis in the US, which began in 2007, resulted in losses on asset's with a

total value of about 35% of the US GDP. Therefore, from the value of losses point of view, the distinction between recession and crisis and early recognition of crisis should be helpful in mitigating severe losses in asset values.

The major impact of any crisis is a devaluation of assets resulting from activity within economic entities and organizations. We may present three types of mechanisms affecting asset devaluation. The first mechanism is associated with decline in revenue, which damages the relationship between net income and revenue (*NI/Revenue*). The second is reflected by increasing debt balance and is combined with a worsening relationship between net income and debt (*NI/Debt*). The third mechanism is related to level of risk and its allocation across the financial and enterprise sectors, and can be expressed by the relationship between return on equity to the risk (*ROE/Risk*). Figure 1 presents major components of each mechanism impacting the assets devaluation. These components represent fundamental factors important for development of any enterprise in respect to funding sources, revenue, and risk. This implies that these three factors should be in some certain balance to mitigate the negative outcome over the financial cycle. The above mentioned balance should be considered both from the perspective of single company and from the perspective of all entities within the financial and enterprise sector.

Figure 1: Main Drivers of Asset's Devaluation over the Financial Cycle



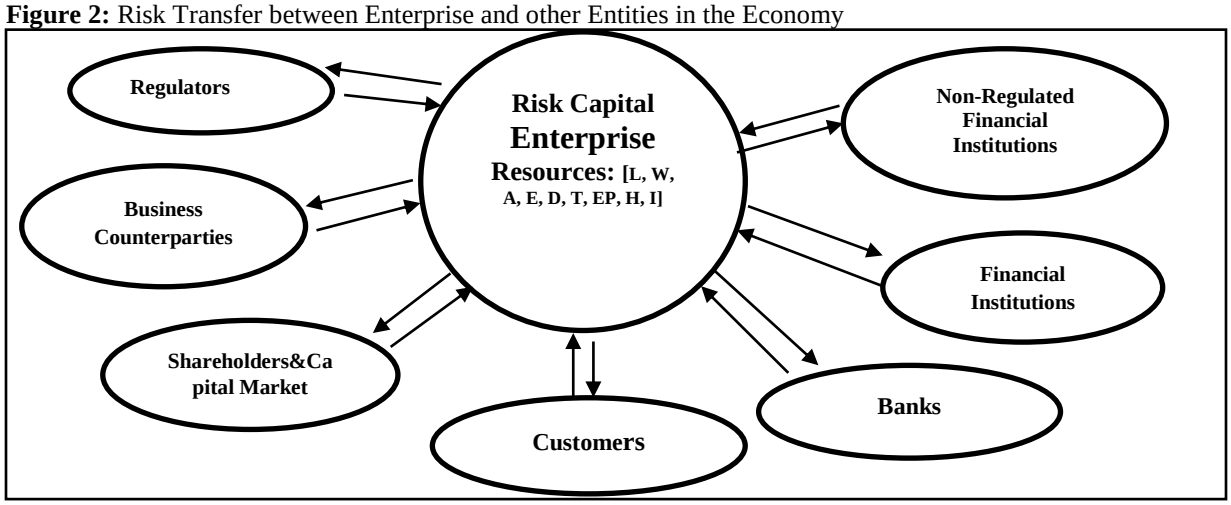
The first mechanism was described by Schumpeter. He claims that if usage of current technology and business concepts lasts too long, euphoria associated with commencement of currently used technology or business ideas may lead to negligence of the innovation and entrepreneurship activity (Skidelsky Robert, 2009). After some time there will likely be a shock (reduction of purchases by customers) causing a decline in revenue, and finally a decline in the net income-to-revenue ratio.

The second mechanism, developed by Minsky, is known as "Financial Instability Hypothesis" (*FIH*), which declares that stability is inherently destabilizing. This is a rather interesting approach to explaining the financial cycles and financial crises therefore we present this concept in greater detail. According to Minsky, financial systems swing between robustness and fragility and these swings are an integral part of the process that generates business cycles (Skidelsky Robert, 2009). Minsky claims that the process leading to the financial crisis is based on increased debt drawn by business entities and households. He partitioned the process from stability to instability into three stages of debt phases: hedge, speculative, and Ponzi. During the hedge phase the borrower's cash flow can cover interest and principal. The debt in that phase can be paid off because it is fully covered by amount of cash flow available by the borrower therefore it is a stabilizing factor for the economy. In the speculative phase the borrower is able to pay only the interest. The bank's customers assume that interest will go down and the value of the asset purchased with the loan will go up; they would be able to pay the principal by selling off the assets. Minsky claims that the longer the economy is stable, the more incentive to speculate, and the more speculative borrowers become. The Ponzi phase is leading toward the bubble. In this phase cash flows cover neither interest rate nor the principal, and it all depends on increase of the assets value to keep borrowers liquid. The Ponzi phase is self-escalating because more and more borrowers become speculators which can lead to further increases in the prices of assets. The borrowers draw more debt to buy new assets hoping to sell them off later using realized profit and generate sufficient cash flow to pay back the principal. This process may endure until the prices decline and, suddenly, all try to sell off their assets leading to a precipitous decline in the value of assets, and ultimately financial crisis (Skidelsky Robert, 2009).

The third mechanism is based on the risk transfer from financial sector to the real economy, and can be observed in great asymmetry of risk allocation measured by return on equity to the volatility ratio. Figure 2 presents a complex multidirectional transaction process between the enterprise and other market entities, which is followed by risk transfer. The risk premium should be considered as an item in cost structure of the transaction price. The overestimation or underestimation of the risk

would result in additional charge to one of the transaction-parties. The cumulative risk should be reflected in risk capital (*RC*) and allocated on the balance sheet to protect enterprise resources against devaluation. All transactions are in strong relation with major resources within the company like: land (*L*), labor (*W*), assets (*A*), equity (*E*), debt (*D*), technology (*T*), entrepreneurship (*EP*), intangible & intellectual assets and human resources (*H*), information (*I*).

Figure 2: Risk Transfer between Enterprise and other Entities in the Economy



Cumulated company resources have certain value, which have to be protected against risk realization. Protection of their value can be obtained by allocating the Risk Capital which as well maximizes the probability of enterprise survival (Krysiak Zbigniew, 2011). To protect the company against default and ensure its survival we need to allocate appropriate skills and resources which are responsible for "doing their job by keeping the company alive" (Smith M. David, 2006). The Risk Capital is responsible for enterprise survival from the perspective of financial resources which are ultimately used to cover any losses against risk realization.

Research Methodology and Results

We have examined financial reports (profit and loss statement and balance sheet), for banks and enterprises from the Wharton database. Data analyzed derive from the period between 1959 -2010, but due to low numbers in the bank sample during the period up to 1969 we can interpret results commencing from 1970. The bank-sample consists of 30 entities in 1970 up to 800 in 1994 and currently in years 2009-2010, the number is around 500. The enterprise-sample consists of 1700 entities in 1970 up to 7000 in 1996 and currently in years 2009-2010, around 4500. Our hypothesis maintains that the banks' funds, allocated to projects in the real economy, cannot yield returns which consistently exceed those realized by the borrowing enterprises and the risk shared between the banking and enterprise sectors cannot be extremely disproportional.

Figure 3: The Ratios: Value of Equity to Total Assets for Banks and Enterprises

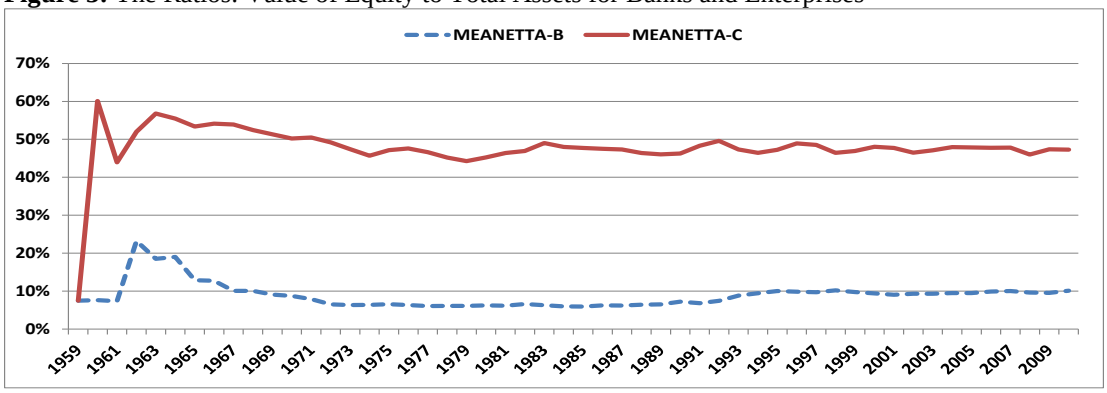


Figure 3 presents value of capital in relation to total assets for banks and enterprises. On average value of equity at enterprises approaches 50% of total assets but at the banks it is only on the level between 6%-10%. The level of equity, in both sectors, reflects the difference in risk assumed by each of them. Assuming that the relationship between risk amongst enterprises and the risk amongst banks should be proportional, we are puzzled by the results shown in figure 4, where we observe that after 1996 the above mentioned relation is inexplicably large approaching, on occasion, a factor of 12.

Figure 4: Relationship between the Enterprises and Banks Risk

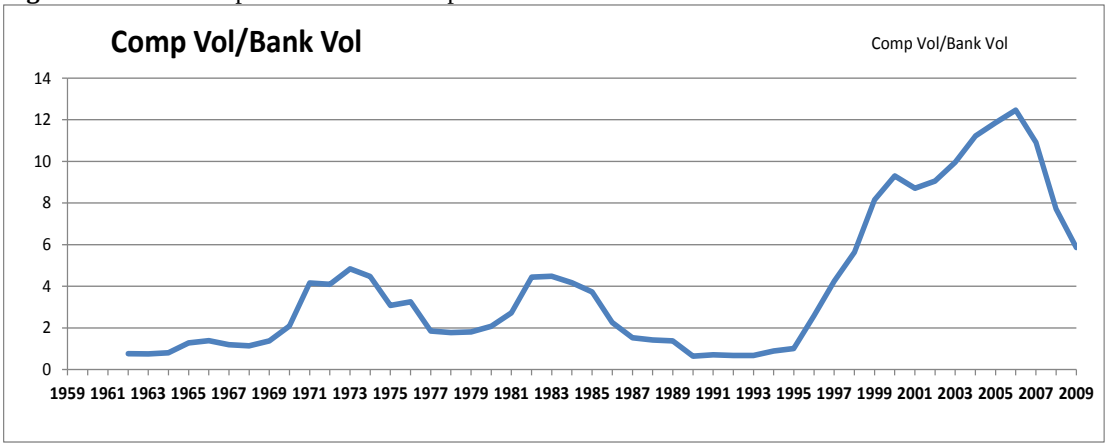


Figure 4 illustrates the relationship between the risk charged to banks and enterprises. From 1970 to 1996 the risk charged to enterprises was between 1-4 times higher than the risk charged to banks. From 1970 up to 1996 we observe interchangeable cyclicality in volatility across both sectors. After 1996 there is substantially greater risk on the enterprise side than on the banks side. The significant difference in risk in favor of banks begins at 1997. In 1999 there was almost 8 times higher risk on the enterprise side than the bank sector. This difference in risk could be assumed as a very early warning signal of financial crisis. This pattern indicates that early warning of financial crisis were available few years before crisis begun.

Figure 5: The Regression between the Enterprise's Return on Equity and its Risk

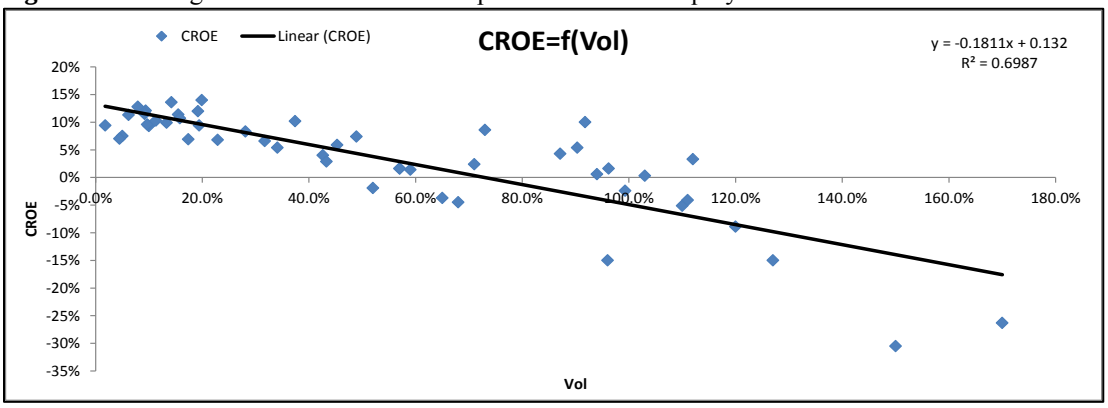


Figure 5 shows a strong dependence of the return on equity from risk expressed by volatility of return on equity. This supports the hypothesis that risk transferred by banking sector into the enterprise sector reduces yields of companies. The declining profits and yields on the enterprise side should raise the concern of banks since the bankruptcy of bank's customers triggers the banks default.

Figure 6: The Difference in the Return on Equity between the Banks and Enterprises

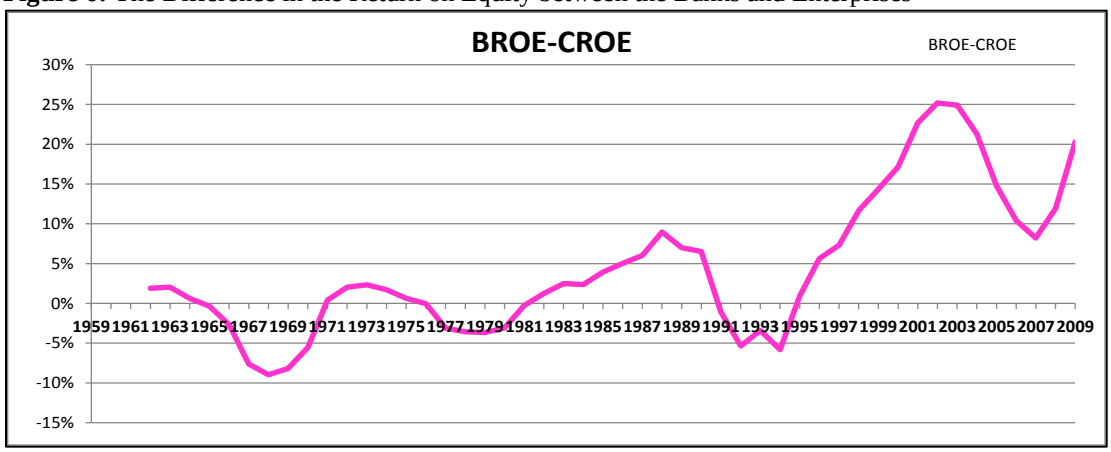


Figure 6 provides the difference in returns gained by banks over the enterprises. This difference was periodically favorable for enterprises or banks from 1970 up to 1996. After 1996 we observe extreme differences favoring banks. This difference exceeds the level of 10 % on average in favor of banks, and at the extreme in period 1999-2005 it is over 20%. This very significant difference in return on equity beginning from 1999 could be assumed as well as an early warning signal of financial crisis. Assuming that the difference of about 5% is justified, so approaching the difference in ROE over 10% in favor of banks should switch on the early warning signal.

Figure 7: The Return on Equity to Volatility Ratio for the Banks and Enterprises

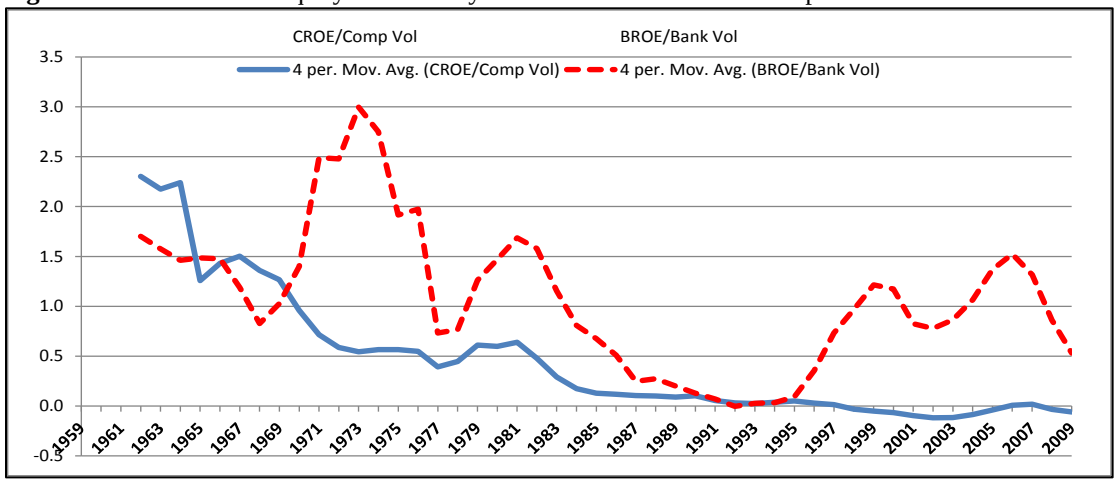
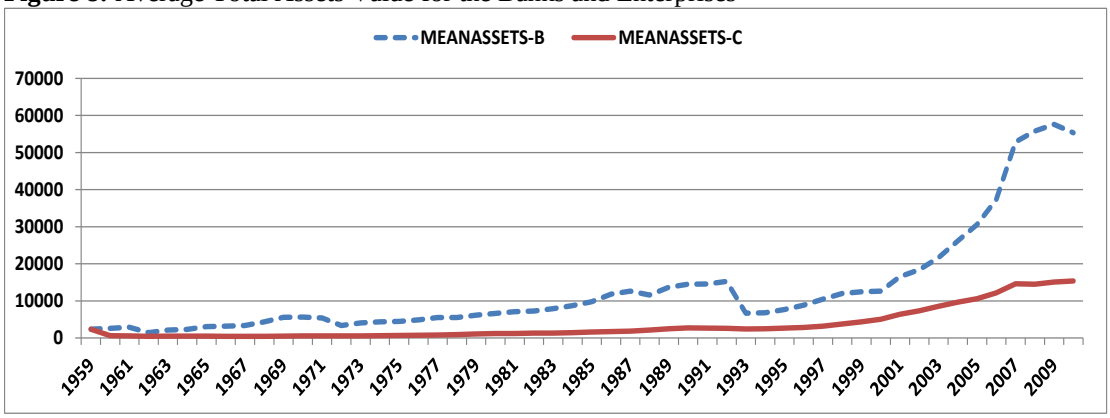


Figure 7 presents the relationship between return on equity and volatility for banks and the enterprises. This ratio reflects how many units of return we obtain from one unit of risk. Up to the 1990 the enterprise sector gained on one unit of risk from 1 unit of return in 1970 to 0.1 unit of return in 1990. In the same period banks gained from 1.1 to 6 times more. The yields allocated to one unit of risk from 1990 up to 1996 are about equal for both sectors. The extremely high difference in yields in favor of banks we observe from 1996 up to 2009. This indicator seems to be even more sensitive than the previous one and it shows that early warning of the crisis could be noticed even early.

Figure 8 presents the average total assets value for the banks and enterprises. From 1996 we observe increasing spread between the banks and enterprise assets value. If the total assets value can be treated as a proxy of the company value then it would imply that with the risk transfer from the financial sector into real economy, there is an associated transfer of value and gains. The risk transfer from banks to the enterprises results in asset's value increase on banks side with devaluation of companies' value. The devaluation of assets value could be interpreted as an impact of discussed mechanisms in previous chapter.

Figure 8: Average Total Assets Value for the Banks and Enterprises



We believe that significant impact on underestimation of enterprises risk had solutions implemented by Basel II, which were questioned by many experts before the implementation process (Danielsson J., Embrechts P., Goodhart Ch., Keating C., Muennich F., Renault O., Shin H., 2001). The Basel II triggered the moral hazard, which likely lead to the underestimation of the loan provisions and the perception of bank about the enterprise's risk.

Conclusions

Banks and financial institutions hold a substantial portion of national assets (banks assets in US around $15 Trillion, roughly equal to the annual GDP) suggesting that any risk associated with transactions between enterprises and financial sector (primarily banks) can have marked impact on the value of enterprise and the economy as well.

From 1996 we have observed unusual disproportion in risk and return measures between the banking and enterprise sectors. This growing asymmetry in risk indicates a potential threat of financial distress. We believe that using the indicators identified in this paper to monitor the risk on micro and macro levels, we might avoid the severe consequences of a major crisis (mitigating the possibly devastating outcomes) and limit the result to what might be considered a "regular" recession?

The crisis case-study delivers much knowledge about its mechanisms on a microeconomic level but there is a little knowledge from a macroeconomic perspective (Acharya Viral V., Richardson M., Van Nieuwerburgh S., White Lawrence J., 2011) and (Duffie Darrell, 2011). Predicting financial crisis is very difficult when based only on technical analysis and the usual assumptions about the rationality of market players (Fox Justin, 2009). Whilst these tools are useful, we think that it may be possible to collect more evidence about crisis proximity if a study is extended to include analysis of risk allocation across the economic entities and sectors.

The invisible risk and its asymmetry is probably the biggest danger in economic development if not analyzed from both the micro and macroeconomic perspectives. The global finance and global financial institutions don't trigger the crisis and don't threaten the future development of the global economy (Hankel Wilhelm, Isaak Robert, 2011), but the danger lies in the systemic deficiencies of risks monitoring, its distribution, and its asymmetry across the market entities. This kind of systemic deficiencies may be reflected by huge share of so called shadow banking system, which can be defined as a collection of financial entities, infrastructure and practices which support financial transactions that occur beyond the reach of existing state sanctioned monitoring and regulation. It includes entities such as hedge funds, money market funds and structured investment vehicles. Investment banks may conduct much of their business in the shadow banking system, but they are not shadow banking institutions themselves. The shadow baking system contributed in the past much to the crisis and which is challenged to moral hazard by not being equally regulated by financial supervisory body

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Acknowledgement

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Why All-Equity Portfolios Still Remain the Exception

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Abstract

Diversification is a widely accepted outcome of mean-variance optimization assuming a riskless asset and uniform risk aversion. Conversely due to differing risk tolerances investors may choose equity only portfolios. We revisit the case for 100% long-term investment in equities. Assuming there is no long-run riskless asset, we solve the investor's portfolio problem and see optimal investment in equity versus corporate bonds leads to a proportion that depends upon one's degree of risk aversion (100% equity is shown to be one possible value, not the most credible). Other contributory evidence suggests that a diversified multi-asset portfolio is still to be preferred.

Introduction

In an economic climate of uncertainty investors are often unprepared for the ensuing chaos of economic and financial crises. Asset allocations based on more conventional financial theory appear to leave investors short in defending their portfolios from rapid shifts and highly correlated co-movements of assets that were previously considered to be uncorrelated based on their historic relationships. This uncertainty typically causes the behavioural biases of investors to move more to the forefront of their evolving investing strategies in times of market stress.

Shefrin & Statman (1985) and Odean (1998) described the fallacy of investors to ride losers and sell winners - a dangerous strategy in a declining and increasing highly correlated market but one that fund managers facing burgeoning redemptions requests against backdrop of reduced liquidity might necessarily adopt. Others such as Croson and Sundali (2005) and Morrison and Ordeshook (1975) identified the gambler's fallacy as a further behavioural bias where investors might assume successive failures eventually lead to a success leading to ever more desperate attempts at 'get-even-it is'. Taken further this might explain the bias of investors riding losers too long.

When this is coupled with the Longshot bias identified by Ali (1977), it may be assumed that investors will inevitably shrink their portfolios by running losers in the hope of a longshot payout, while decreasing their level of diversification by encashing-in their best performers. Conversely, more risk-averse investors may choose to flee from an asset class such as equities altogether, or even herd into one asset class only i.e. "risk-less" fixed income instruments, under the misguided belief that it would prove to be a long-term safe haven.

The purpose of this paper is to reconsider the case for not investing 100% of one's assets in equities over the long-term given superior historical return characteristics that appear to have dominated other assets classes. Our work specifically builds on the paper by Clifford Asness (1996) who made a clear case for not doing this. Since then, there have been a number of new developments that need to be considered to update the analysis of Asness. Among the foremost of these are the introduction of Treasury Inflation Protected Securities (TIPS) in the US in 1997; the case for universal or super portfolios, by which we mean the work of Cover (1996) *et al.*, and the important work on strategic asset allocation by Campbell and Viceira (2002).

We present arguments based on mean-variance analysis, the so-called practitioner's utility function. The use of this framework allows us to get an expression as to when we could prefer 100% equity to a mixed portfolio of equity and bonds and when we would not. Our argument differs from Asness in that we do not assume the existence of a risk-less asset, certainly there has not been one historically; whether TIPS provides one remains a point of contention worthy of further discussion. This assumption has the implication that the Asness argument (op. cit, page 32) "Modern finance says first construct the optimal portfolio of risky assets, and then choose how much to either lend or borrow of the risk-less asset" needs to be modified accordingly. Otherwise, however, we follow his choice of variables (S&P500, Ibbotson's total return series for long-term corporate bonds) and extend his data period (1926-2010). However, our analysis is much more general in the sense that it would also apply if we extended our list of asset classes to include overseas equity and bonds, alternative investments, and, indeed any other asset choice.

We now present our analysis, together with other considerations, including discussions of the influential work of Cover (1996) and Campbell and Viceira (2002). This is followed by our results section and finally our conclusions.

Analysis & Discussion

We first need to explain why we think it is appropriate not to assume the existence of a risk-less asset, which is a point in which we take a different approach from that of Asness. We think of a risk-less asset as one that will deliver a known quantity of "consumption", by which we mean consumable wealth, at some future date. A conventional bond will not do this because although it may be guaranteed to pay a certain nominal amount at maturity, that amount will itself be eroded by the prospective and unknown rate of inflation.

An index-linked bond such as Treasury Inflation Protected Securities (TIPS in the US), or Consumer Price Indexed-linked bonds might appear to be a suitable candidate for a risk-less good, with commensurate effects on individual and institutional asset allocation decisions, since these securities are thought to represent a true long-run hedge against inflation risk. Whilst it is true such instruments are established across a number of government bond markets now, including the US, UK, Australia, Canada, Netherlands and Sweden, there remains significant differences between the index linked characteristics in each of these markets, as there is appears no uniformity in market structure, depth or liquidity. Even then, there are still residual risks from a variety of sources. Quite apart from Sovereign risks, these include the fact that there is often different tax treatment of indexed-linked bonds, miss-timings or lags - of up to 8 months[1] - in the calculation of the inflation rate relative to the time-period in question, the unavailability of very long-dated TIPS[2] and the general supply-demand imbalance in the TIPS market (which pushes up the price for TIPS and consequently under-estimates the rate of inflation). Finally the rate of inflation evolves as does its definition, so that the methodology behind the rate used at the time of purchase of a TIPS security may well be different in unforecastible ways from the methodology used at the time of anticipated maturity.

Traditional economic theory states that the level of real interest rates, in the long run, has been relatively constant; being the real cost of capital, influenced by the level of real growth in Gross Domestic Product (GDP) in an economy i.e. changes in underlying productive technology.[3] Thus, index-linked bonds should move only in line with it; whereas practical observation of bond market data demonstrates that bond prices exhibit considerable volatility even within the global indexed-linked market. This has profound effects with respect to dedicated portfolios required for Asset and Liability management in the context of global retirement portfolios, particularly in respect of inflation-protected retirement annuities.[4]

In this paper, we consider the simplest case of two assets, both risky, labelled 1 and 2. Their returns we denote as r_1 and r_2, with $E(r_i) = \mu$ and $\mathrm{Var}(r_i) = \sigma_i^2$, where $i = 1, 2$, whilst the covariance $(r_1, r_2) = \sigma_{12}$. We also denote the proportion held in equity (asset 1) to be α, so that the proportion held in non-equity assets (asset 2) is $1 - \alpha$. Moreover we assume that our investor has a negative exponential utility function, which will have a constant absolute risk aversion (CARA) property and is a particularly useful utility function for mean-variance analysis. Thus:

$$U(w) = 1 - e^{-\lambda w}, \text{ and absolute risk aversion } = -\frac{U''(w)}{U'(w)} = \lambda \tag{1}$$

The coefficient of risk aversion measures the required return per unit of variance tolerated, that is, $\lambda > 0$ implies an investor is risk-averse. In this paper, we assume the coefficient of absolute risk aversion takes values in the range of $1 \le \lambda \le 3$, which is in line with the recommendations found in Grinold (1996) *et al.*. We note that in this area, Grinold's views are highly regarded in the literature as well as in practitioner circles. Intuitively, λ measures our degree of risk aversion; a high value would mean that we are likely to have less equity and more cash in our optimal portfolio, a low value of course would concomitantly imply the opposite. Indeed this anticipated outcome is exactly what we see in our subsequent calculations.

Our long-term investor chooses α in order to maximise his/her value V, or expected utility *E (Utility)*; which corresponds to a transformation of the original utility; where:

$$E(Utility) = V = \mu - \frac{\lambda}{2}\sigma^2 \tag{2}$$

$$\underset{\alpha}{Max}\ V = \alpha\mu_1 + (1-\alpha)\mu_2 - \frac{\lambda}{2}(\alpha^2\sigma_1^2 + (1-\alpha)^2\sigma_2 + 2\alpha(1-\alpha)\sigma_{12}) \tag{3}$$

By the use of calculus, we can readily see that:

$$\text{Optimal } \alpha = \frac{(\mu_1 - \mu_2) - \lambda(\sigma_{12} - \sigma_2^2)}{\lambda(\sigma_1^2 - 2\sigma_{12} + \sigma_1^2)} \tag{4}$$

Thus an unlevered portfolio would have $0 \le \alpha \le 1$; a 100% equity portfolio would thus have $\alpha = 1$.

Our choice of functional form for V is deliberate since it captures a number of desirable features. Firstly, we get explicit solutions such as (3). Secondly, it is the standard utility function employed in most practitioner optimisation calculations implying a greater applicability. Thirdly, it also has sound theoretical foundations in that it can be derived from constant absolute risk aversion utility functions and normal portfolio returns. Next we must consider which features of real investment our model captures, and which ones it does not. What it does not capture very effectively are some of the subtleties to do with the age of the investor and investor's wealth. Much of this is tied up with bankruptcy risk and bequest issues, which are not explicitly included in our model.

For example, *ceteris paribus*, a wealthier investor may take large investment positions in risky assets later in life if he has sufficient residual assets to cover his own retirement. In this sense risk aversion should be inversely related to the residual time decay of the anticipated remaining retirement horizon and ensuing expected longevity risk; but positively correlated to the wealth function and the general level of social welfare provisioning. Similarly, issues of asset illiquidity and the time-horizon of the investment are directly addressed.

We now consider a number of factors that might influence our answer. Firstly, and in many ways, most importantly, the proportion we will hold in equity will be determined by our attitude to risk; specifically in our model, the parameter λ, which corresponds to the coefficient of absolute risk aversion. In line with the institutional investment literature, we have chosen values between one and three. To get a large weighting in equity, we may need to reduce λ down to much smaller numbers, in effect making our investor less risk-averse (although it might be that this is explained because we are ignoring the non-private forms of income in retirement e.g. Social Security which in effect acts like an index linked government bond investment). Numbers greater than four do not seem to be relevant as this would imply an exceptional risk taking appetite, which could not be justified on the basis of even the most generous of social welfare programs such as in Sweden. Outside institutional investment, it seems hard to pin down a recommended value for λ. A study by Hartog *et al.* (2000) suggests a functional form for the choice of λ, rather than a quantity, where risk aversion is determined by demographic factors, and where there are no issues to do with the time horizon of the investment problem. We will return to this issue when we look at our results.

As mentioned earlier, the time horizon of the investment problem is itself a major issue. While we have discussed earlier that global meltdowns can cause behavioural changes that may affect an investors short term investment horizon, behaviour may eventually settle down in the longer run as stable economic conditions are restored; so, generally we are interested in long-term investment issues. Implicitly our horizon for this model is likely to be of the order of 10 to 40 years reflecting the range of retirement horizons of a cross section of the working population. Over that time frame, it is likely that our forecasts of mean and variance could well be affected by the time horizon; however it may be long enough to outlast the current global financial crisis leaving investors with a larger range of "safe" assets once again. The way in which the time horizon will influence our forecasts of mean and variance depends upon the stochastic process that we believe prevails in generating returns. Our modelling assumes, for simplicity, that returns are independently and identically distributed, and that means and variances increase linearly with time. Suppose, however, that our prices were mean reverting, so that periods of excessive returns are likely to be followed by periods of lower returns. This means that the process in the long run will be less volatile, per unit of time, as a result. Thus, equity, if it mean-reverts more than other asset classes, should benefit from this phenomenon and become relatively more attractive as timelines increase. This is an issue in our calculations, because we have estimated all our parameters using monthly data. If we extrapolate our estimates to say a 20-year horizon, then our expected returns will scale up linearly, whilst our variance may scale less than linearly; we shall return to this point again when discussing our results.

We now discuss the important contribution by Campbell and Viceira (2002) to the debate on long-term investment. These authors have utilised power utility functions and lognormal asset returns to model long-term decision making. This is an alternative to our approach and there are a number of theoretical arguments in their favour, but also a number of problems, which we shall not address here. They set up their model as a multi-period optimisation, not a single period one as we have done. They focus on the identity of the long-term riskless asset, warning the reader that it is not cash, but long-term bonds that is the relevant choice. Our solution goes a stage further in that we would argue that there is no long-term safe asset for the market as a whole, given the duration and volume of TIPS, the reasons already given above, and the unavailability of such index-linked bonds before 1997 (in the US, or 1981 in the UK), so that, for the duration of our estimation period, this investment choice was not actually available. We shall, however, consider both nominal and real returns.

We next consider the theory of universal portfolios due to the work of Cover (1996). This is one of a number of theories which create, in a broad sense growth-optimal portfolios. The problem is usually applied to a universe of stocks, rather than a universe of asset classes. However, there is nothing in the mathematics of the procedure that precludes applying his methodology to asset classes. What Cover does show is that his universal portfolio will outperform any given asset class, (see Proposition 1, page 5). This is a minor lemma in his paper but has major implications for us in that, in his framework at least, which is about the maximisation of the expected logarithm of wealth, an attractive "universal" portfolio will not be a single asset class, but a combination of different asset classes.

Results

Consider our solution for optimal weight of equity:

$$\alpha = \frac{(\mu_1 - \mu_2) - \lambda(\sigma_{12} - \sigma_2^2)}{\lambda(\sigma_1^2 - 2\sigma_{12} + \sigma_2^2)} \tag{5}$$

We may wish to restrict α so that $0 \le \alpha \le 1$ to impose borrowing & short selling constraints, in which case,

$$(\mu_1 - \mu_2) \ge \lambda(\sigma_{12} - \sigma_2^2) \text{ and } (\mu_1 - \mu_2) - \lambda(\sigma_{12} - \sigma_2^2) \le \lambda(\sigma_1^2 - 2\sigma_{12} + \sigma_2^2) \tag{6}$$

$$\text{Therefore, } \alpha = 1 \Leftrightarrow (\mu_1 - \mu_2) - \lambda(\sigma_{12} - \sigma_2^2) = \lambda(\sigma_1^2 - 2\sigma_{12} + \sigma_2^2) \tag{7}$$

$$\Leftrightarrow (\mu_1 - \mu_2) = \lambda(\sigma_1^2 - \sigma_{12}) \tag{8}$$

Surprisingly, the condition for α = 1 depends only on the expected excess return of equity over asset 2, the variance of equity, and the covariance between equity and asset 2, but not however on the variance of asset 2. If we buy equity and US short term treasury bills (assuming, erroneously, that they are riskless in a long-run sense), then $\mu_2 = r_f$, $\sigma_{12} = 0$, $\sigma_2^2 = 0$ and $(\mu_1 - \mu_2) = \lambda\sigma_1^2$ for α = 1.

Our empirical results are presented within the following tables. Table 1 illustrates our empirical findings based on our analysis of the adjusted real returns data set. Table 2 presents our empirical results based on the original nominal returns data series. Tables 3 & 4 show the portfolio returns of the non-equity investments as measured against the S&P500 and our Small Stock equity portfolios respectively, again in real terms. Table 5 & 6 complements this analysis by providing the portfolio returns against the underling nominal return data as based on the original series.

Table 1: Empirical Results

Statistic Summary	***S&P500***	***Small Stock***	***L.T. Corporate***	***T-Bill***	***Cash***
Mean	0.73%	1.10%	0.25%	0.06%	-0.25%
Variance	0.0031	0.0072	0.0004	0.0000	0.0000
Standard Deviation	5.59%	8.49%	2.09%	0.53%	0.53%
Covariance Matrix	***S&P500***	***Small Stock***	***L.T. Corporate***	***T-Bill***	***Cash***
S&P500	**0.0031**	0.0039	0.0003	0.0000	0.0000
Small Stock	0.0039	**0.0072**	0.0003	0.0000	0.0000
LT Corp	0.0003	0.0003	**0.0004**	0.0000	0.0000
T-Bill	0.0000	0.0000	0.0000	**0.0000**	0.0000
Cash	0.0000	0.0000	0.0000	0.0000	**0.0000**
Correlation Matrix	***S&P500***	***Small Stock***	***L.T. Corporate***	***T-Bill***	***Cash***
S&P500	**1.0000**	0.8274	0.2266	0.0892	0.1084
Small Stock	0.8274	**1.0000**	0.1713	0.0310	0.0587
LT Corp	0.2266	0.1713	**1.0000**	0.3186	0.3046
T-Bill	0.0892	0.0310	0.3186	**1.0000**	0.8863
Cash	0.1084	0.0587	0.3046	0.8863	**1.0000**

Returns are in Real Terms; Data from 1926 (January) – 2011 (December), monthly data, 1020 observations

In cases (1a-1c), we based these on the historical returns obtained for the period of 1926-2010, and calculated the optimal weight of S&P500 (asset 1) in different two-asset portfolios with non-equity assets (asset 2). The implied coefficients of absolute risk aversion for investing 100% in S&P500 in two-asset portfolios with long-term corporate bond, short-term Treasury Bills and money are 1.677, 2.179 and 3.163 respectively; In cases (2a-2c), we do the same calculation except that S&P500 is replaced by Small Capitalization Stocks, and the implied λ for investing 100% in Small Capitalization Stocks in two-asset portfolios with long-term corporate bond, short-term Treasury Bills and money are 1.229, 1.451 and 1.876 respectively. The computed implied coefficients of absolute risk aversion are broadly consistent with our initial assumption that λ lies between a range of one and three. In all of the cases presented above, the results suggest that it is optimal to hold 60% (or 40% if Small Capitalization Stocks are used

instead of S&P500 as asset 1) to 100% (if a short position is not allowed) of equity in the portfolio, if one's coefficient of risk aversion lies between one and three. The optimal weights on equity and the implied volatility of equity, such that one would invest 100% in equity for different values (1, 1.5, 2, 2.5 and 3) of λ our coefficient of risk aversion, are also computed and presented in the aforementioned tables.

Table 2: Empirical Results

Statistic Summary	***S&P500***	***Small Stock***	***L.T. Corporate***	***T-Bill***	***Cash***
Mean	0.98%	1.35%	0.50%	0.30%	0.00%
Variance	0.0031	0.0072	0.0004	0.0000	0.0000
Standard Deviation	5.56%	8.48%	2.00%	0.25%	0.00%

Covariance Matrix	***S&P500***	***Small Stock***	***L.T. Corporate***	***T-Bill***	***Cash***
S&P500	**0.0000**	0.00	0.00	0.00	0.00
Small Stock	0.0000	**0.01**	0.00	0.00	0.00
LT Corp	0.0000	0.00	**0.00**	0.00	0.00
T-Bill	0.0000	0.00	0.00	**0.00**	0.00
Cash	0.0000	0.00	0.00	0.00	**0.00**

Correlation Matrix	***S&P500***	***Small Stock***	***L.T. Corporate***	***T-Bill***	***Cash***
S&P500	**1.00**	0.83	0.20	-0.02	0.00
Small Stock	0.83	**1.00**	0.16	-0.04	0.00
LT Corp	0.20	0.16	**1.00**	0.09	0.00
T-Bill	-0.02	-0.04	0.09	**1.00**	0.00
Cash	0.00	0.00	0.00	0.00	**1.00**

Returns are in Nominal Terms; Original Data from 1926 (January) – 2011 (December), monthly data, 1020 observations

Table 3: Case (1) Real Returns & S&P500 is Asset 1

Case (1a): S&P500 (Asset 1) versus Long term Corporate Bonds (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	0.48%	0.29%	163.89%	0.0051
1.5	0.48%	0.43%	111.15%	0.0035
2	0.48%	0.57%	84.77%	0.0027
2.5	0.48%	0.71%	68.95%	0.0022
3	0.48%	0.86%	58.40%	0.0019

Weight of equity = 100% if, and only if, risk aversion = 1.677

Case (1b): S&P500 (Asset 1) versus Treasury Bills (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	0.67%	0.31%	217.80%	0.0068
1.5	0.67%	0.46%	145.22%	0.0045
2	0.67%	0.62%	108.93%	0.0034
2.5	0.67%	0.77%	87.15%	0.0027
3	0.67%	0.93%	72.63%	0.0023

Weight of equity = 100% if, and only if, risk aversion = 2.179

Case (1c): S&P500 (Asset 1) versus Money Market (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	0.98%	0.31%	316.59%	0.0098
1.5	0.98%	0.46%	211.02%	0.0066
2	0.98%	0.62%	158.23%	0.0049
2.5	0.98%	0.77%	126.56%	0.0039
3	0.98%	0.93%	105.45%	0.0033
3.5	0.98%	1.08%	90.37%	0.0028

Weight of equity = 100% if, and only if, risk aversion =3.163

Table 4: Case (2) Real Returns & Small Stock is Asset 1

Case (2a): Small Stock (Asset 1) versus Long term Corporate Bonds (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	0.85%	0.69%	122.49%	0.0088
1.5	0.85%	1.04%	82.28%	0.0060
2	0.85%	1.38%	62.18%	0.0045
2.5	0.85%	1.73%	50.12%	0.0037
3	0.85%	2.07%	42.08%	0.0031

Weight of equity = 100% if, and only if, risk aversion = 1.229

Case (2b): Small Stock (Asset 1) versus Short Term Treasury Bills (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	1.04%	0.72%	145.03%	0.0104
1.5	1.04%	1.08%	96.75%	0.0070
2	1.04%	1.44%	72.61%	0.0052
2.5	1.04%	1.80%	58.13%	0.0042
3	1.04%	2.16%	48.47%	0.0035

Weight of equity = 100% if, and only if, risk aversion = 1.451

Case (2c): Small Stock (Asset 1) versus Money Market (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	1.35%	0.72%	187.58%	0.0135
1.5	1.35%	1.08%	125.06%	0.0090
2	1.35%	1.44%	93.80%	0.0068
2.5	1.35%	1.79%	75.05%	0.0054
3	1.35%	2.15%	62.54%	0.0045

Weight of equity = 100% if, and only if, risk aversion =1.876

Table 5: Case (3) Nominal Returns & S&P500 is Asset 1

Case (3a): S&P500 (Asset 1) versus Long term Corporate Bonds (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	0.48%	0.29%	164.27%	0.0050
1.5	0.48%	0.43%	111.40%	0.0034
2	0.48%	0.57%	84.96%	0.0026
2.5	0.48%	0.72%	69.10%	0.0022
3	0.48%	0.86%	58.53%	0.0018

Weight of equity = 100% if, and only if, risk aversion = 1.681

Case (3b): S&P500 (Asset 1) versus Treasury Bills (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	0.68%	0.31%	218.28%	0.0068
1.5	0.68%	0.46%	145.62%	0.0045
2	0.68%	0.62%	109.29%	0.0034
2.5	0.68%	0.77%	87.49%	0.0027
3	0.68%	0.93%	72.96%	0.0023

Weight of equity = 100% if, and only if, risk aversion = 2.186

Case (3c): S&P500 (Asset 1) versus Money Market (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	0.98%	0.31%	317.31%	0.0098
1.5	0.98%	0.46%	211.54%	0.0065
2	0.98%	0.62%	158.66%	0.0049
2.5	0.98%	0.77%	126.93%	0.0039
3	0.98%	0.93%	105.77%	0.0033
3.5	0.98%	1.08%	90.66%	0.0028

Weight of equity = 100% if, and only if, risk aversion =3.173

Table 6: Case (4) Real Returns & Small Stock is Asset 1

Case (4a): Small Stock (Asset 1) versus Long term Corporate Bonds (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	0.85%	0.69%	122.58%	0.0088
1.5	0.85%	1.04%	82.32%	0.0059
2	0.85%	1.38%	62.18%	0.0045
2.5	0.85%	1.73%	50.11%	0.0037
3	0.85%	2.08%	42.05%	0.0031

Weight of equity = 100% if, and only if, risk aversion = 1.230

Case (4b): Small Stock (Asset 1) versus Short Term Treasury Bills (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	1.05%	0.72%	145.12%	0.0104
1.5	1.05%	1.08%	96.82%	0.0070
2	1.05%	1.44%	72.67%	0.0052
2.5	1.05%	1.80%	58.18%	0.0042
3	1.05%	2.16%	48.52%	0.0035

Weight of equity = 100% if, and only if, risk aversion = 1.452

Case (4c): Small Stock (Asset 1) versus Money Market (Asset 2)

Risk Aversion	$(\mu_1 - \mu_2)$	$\lambda(\sigma_1^2 - \sigma_{12})$	***Optimal α***	***Vol. of Equity s.t. 100%***
1	1.35%	0.72%	187.70%	0.0135
1.5	1.35%	1.08%	125.14%	0.0090
2	1.35%	1.44%	93.85%	0.0068
2.5	1.35%	1.80%	75.08%	0.0054
3	1.35%	2.16%	62.57%	0.0045

Weight of equity = 100% if, and only if, risk aversion =1.877

We consider both returns in real terms and nominal terms, in cases (3a-3c) and (4a-4c), we carried out similar analysis on returns in nominal terms (unadjusted for inflation) from our original data and found very similar results as cases (1a-1c) and (2a-2c). It is clear from our results that to hold 100% in equity, we need to have a specific level of risk aversion, and so we now look for support for such a value in the finance literature.

We shall briefly survey some articles that present different views as to what risk aversion should be. Grinold (1996) advocates computing this parameter based on an efficient portfolio's Sharpe ratio divided by the equity assets standard deviation. This is the authoritative reference in institutional investment literature and has been widely accepted and referenced. Grinold (1996, footnote 8, page 40) suggests Sharpe ratios ranging from 0.3 to 0.4 and annualised standardised deviations from 9% to 18%. This gives a range for λ of about 1.6 to 2.5, and is broadly compatible with the sorts of numbers used in our study

In contrast to the above, we now consider a number of studies that are based on analysis of individual preferences, rather than aggregate ones. For example, Cohen and Einav (2005), who study insurance deductibles, note that "…The implied coefficient of absolute risk aversion from this exercise is $2.9*10^{-4}$. One can implicitly solve for the coefficient of risk aversion using the CARA specification, which gives a slightly lower value of $2.5*10^{-4}$….". As another example, Metrick (1995) who imposes the CARA utility function, and estimates the coefficient of absolute risk aversion (for a representative player in "Jeopardy") to be $6.6*10^{-5}$, whilst Gertner (1993) finds a lower bound of the CARA coefficient (for a representative player in "Card Sharks") to be $3.1*10^{-4}$.

Towards a Correct Level of Risk Aversion

Considering both sources of evidence, it seems clear that risk attitudes of people in game shows or who are reviewing their personal finance, are behaving quite differently from that observed among institutional investors. It seems clear, and has been commented upon by others before us, that it is hard to infer much about real investment behaviour from college experiments, game shows, and so forth. Whilst it is perfectly possible for lots of individuals who have high risk-tolerance to be aggregated to a representative or institution with low risk tolerance, this would require a separate paper to find such links and so we shall not explore this point further here.

It remains to discuss the links between a low level of risk-aversion (λ) and the nature of the resulting optimal portfolio. Intuitively, low relative risk aversion will lead to a riskier choice of portfolio and hence a more dispersed portfolio of final wealth values; the probability of high returns may indeed go up, but concomitantly the probability of low returns must do so as well. This is not the final answer however as these statements can be quantified in terms of the probability of under-performing some benchmark or target. Since these return references tend to be investor-specific, we will not elaborate further on such implications.

Conclusions

We have extended an analysis of the case for 100% equity to the situation where there is no true risk-less asset available to the long-term investor. We have considered the recent contributions of other authors to long-term portfolio choice. We have identified behavioural biases that may play a role in the thinking of investors as they shift from diversified to lower diversification portfolios. Whilst we cannot say in every case that 100% equity is sub-optimal in the long run, the broad evidence is that it will be for many investors whose risk aversion tends towards the higher end of the range of plausible values. This is perhaps not surprising; equity is relatively very volatile to other asset classes, taken in terms of annualised standard deviation or Sharpe ratio terms. Arguments that equity mean reverts, and hence represents a lower long-term risk will still not save us, as the same case can be made for other asset classes of course.

Our arguments extend naturally to multiple asset classes, including overseas equities and bonds, to options and futures, commodities, rare paintings, numismatics and forestry. More generally, to be 100% in any given asset class seems to be a special case, except in rather special circumstances. Indeed, we must conclude that diversification is still alive and well and that we should therefore still not invest 100% in equity, even in the long run**.**

Notes

1. The existence of a lag (e.g. 8 months in the case of the UK) means that inflation protection will be unavailable during this period (which is thereby exposed to inflation risk), and must be taken into account when analysing a bond.
2. See 'Growing the TIPS Market Through the Introduction of Additional Long-dated TIPS Maturities'; http://archives1.sifma.org/regulatory/long-dated_tips_comment_letter.pdf .
3. Siegel J.J., Warner, J.B., "Indexation, the Risk Free Asset and Capital Market Equilibrium", *Journal of Finance*, Vol. 34, No.4, September 1977.
4. The introduction of index-linked bonds eliminates one of the main obstacles to the indexation of benefits in private pension plans; since a firm can hedge the risk associated with a long-term indexed liability by investing in index-linked bonds with the same duration as the underlying indexed liabilities.

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The Continuing Problem of the Standard IPO Contract

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Abstract

Controversy concerning the level of gross fees involved in U.S. Initial Public Offerings (IPOs) continues. Chen and Ritter (2000) documented that the majority of IPOs ranging between $20 and $80 million charge a 7% gross fee and suggested that there were some anticompetitive aspects to this market. Other research documented that the similarity of contracts extended to a standard split of 20 % management fee, 20% underwriting fee and 60% selling concession. The issue of the noncompetitive nature of the market persists. The authors find that the standard contract of 7% of gross fees with the 20/20/60 split continues.

Introduction

Chen and Ritter's (2000) disclosure of the relative uniformity of the gross spread of 7% on U.S. Initial Public Offerings attracted considerable attention at the turn of the millennium. The salient issue is the high gross spread received by underwriters of Initial Public Offering in the United States, which is much higher than in other countries. In addition to the high level of costs, the relative uniformity of the fees is perplexing. An IPO would be expected to have an initial minimum fixed cost and one would expect a significant declining cost curve. Chen and Ritter expected economics of scale, but found that there was a clustering of fees in the $20-80 million range. Chen and Ritter examined 1,111 IPOs, excluding certain types of deals like REITs, ADRs and closed funds, ranging between $20 and $80 million in the United States from 1995 to 1998. They found that 90% of these middle sized issues have a gross spread of exactly 7%. This compared with only 25% in the size range in the earlier period of 1985 to 1987. The facts hinted at possible anticompetitive activity. Chen and Ritter found that from 1995 to 1998, the IPO gross spreads in other countries such as Australia, Japan and Europe were about half of those in the U.S. and did not show any evidence of clustering. The evidence suggested that the spread in deals above $30 million was above competitive levels.

Hansen (2001) disagrees on the issue of whether collusion rents exists in the IPO market place. He suggests that the observed clusters do not imply there is collusion. Hansen suggests that the standard pricing is part of a simple standardization of the IPO underwriting contract, but there is a real competition taking place through the quality aspects of the transaction. In other words, the competition is there, but it is non-price competition for superior services like higher quality analyst coverage, placement services, or more optimal level of underpricing. Cliff and Denis (2004) examine an aspect of non-price competition by investigating the role of analyst coverage in IPOs. Consequently, Hansen argues that the 7% spread per se is not evidence of a lack of competition because the contract is really 7% plus other services.

Hansen examines the concentration in the U.S. underwriting market, difficulties of getting into underwriting, the frequency of 7% gross spreads after the announcement of antitrust investigations, and then performs a test of outliers. His evidence supports his conclusion that the 7% U.S. gross spreads are not collusive and they are part of a standardized IPO contract which competes on quality dimensions such as analyst coverage and underwriting reputation. Torstila (2003) pointed out that clustering is widespread in many countries, but with lower gross spread levels. For example he points out that many Asian countries had standardized 2% or 3%. Consequently, Torstila argued that the clustering patterns need not to be collusive because at the much lower gross fee levels there is still a very high degree of clustering.

According to Hansen (2001) the issue of uniformity of gross spread may be closely related to another anomaly associated with IPOs, underpricing. IPO underpricing is the tendency of underwriter to leave "money on the table" by pricing IPOs often initially trade at prices below their expected first day closing price. This underpricing has been documented by numerous authors (Ritter (1984 and 1987), Smith (1986) and Hanley (1993). The total cost of an issue consists of both direct costs and indirect costs. The largest of the direct cost is the gross spread to the underwriter. The indirect costs are associated with the underpricing. It must be remembered that the underwriter typically maintains an option which typically allows the lead underwriter to purchase an additional 15% of the total issue at a later time. When the initial underpricing is combined with the gross spread, the total is often over 15% but is relatively variable. Consequently, total compensation to underwriters is not clustered, only the direct component, the gross spread is. When first documented, the underpricing phenomenon was quite a puzzle. Tinc (1988) points out the liability issues may be at the heart of the underpricing issue. He cites evidence that the underpricing in the IPO market was only 5% prior to the passage of the Securities Act in 1933. After the Securities of 1933 the IPO underpricing was estimated to rise as high as 11%. Tinc points to the due diligence rules contained in the 1933 act as the source of issuer's concern. Other authors have suggested that there is link between underpricing and legal liability (Alexander, J.C. (1993) Drake and Vetsuypens, (1993) Beatty and Welch, (1996) Hensler, D (1995) Hughes and Thakor (1992) Lowry and Shu (2002)).

A number of authors investigated the cause of these high spreads. Some authors suggest that difference could be due to prevalence book building in the United States—a process where investment banks survey institutional investors to obtain legally nonbinding but serious indication of interest before IPOs. Book building was a primary difference from the cheaper fixed price method or tender/auction process methods used in Europe discussed by Jenkinson and Ljungqvist (2001) and Ritter (2003). Chen and Ritter suggested some possible reasons for the high gross spread in U.S. are as follows: Underwriter prestige results in pecking order implying that the competition is non-price; Little competition because of thin analyst coverage; Possibility of implicit or explicit collusion; High fees needed to induce underwriters to do a credible job of certifying the quality of the equity offering. Interestingly, an SEC investigation into these fees was launched following publication of the Chen and Ritter article.

In addition to the high level of fees, another aspect of the IPO contract terms, the uniformity of the division of the fees among the underwriters seemed perplexing. In 2001, building upon the Chen and Ritter foundation, Sami Torstila's paper, "The Distribution of Fees within the IPO Syndicate," examined the components of the gross spread from 1900 to 1999. Torstila's paper not only suggested that standardization was prevalent in the gross spread, but that terms and conditions of the components of the spread were also converging. Investment bankers who issue IPOs typically form a syndicate consisting of three groups, a managing group, an underwriting group and a selling group. The common practice of these investment bankers is to divide the fee with 60% for the selling group and 20% for the managing and underwriting group.

In Torstila's paper, the potential sources of difference in the fee split among the underwriter are analyzed. Torstila suggest that there are four categories of influences which help determine the the potential split of the gross fee among the underwriters. These influences are: 1) the costs of the offering, 2) the bargaining power of the lead bank 3) offering risks, and 4) alternative sources of compensation. As he examines these influences he develops a number of hypotheses concerning issue size and the split of the fees. He finds that proceeds and IPO gross offering size are highly correlated. He argues that larger IPOs are most costly to sell and therefore large offerings should have larger selling concessions. Consistent with his hypothesis he finds that larger offering do have larger selling concessions. He argues that costs should create and inverse relationship between issue size and management and underwriting fees. He finds no support that bargaining power affects the split. He finds limited support for the proposition that risk affects the split. Finally, he finds that the use of warrant in an offering tends to affect the selling concession.

Torstila explores the issue of standardization of the breakdown of the fees among participates of the offering. Torstila indicated that the 20/20/60 split was common and it increased between the years of 1990 to 1999. Using one of his measures of the split he suggested that the incidence grew from 10% to 36% during that decade. Our investigation reveals that although the 20/20/60 standard split is still not universal, it seems to be more prevalent than in the 1990s. According to Torstila's paper, under one-third of all U.S. IPOs in the 1990s followed the standard split. Our investigation of where the split was reported (not every transaction reported the split) indicates a very high prevalence of the standardized breakdown in the 2000 to 2010 period. Our investigation period appears to display a modest increase in the phenomena as we see an increase using one of our definitions of rounding from 65% in 2000 to 70% in 2010. The actual percentage is probably higher because Bloomberg did not fully disclose the fees in many cases.

Initially we thought that our investigation as to whether the original issue in this area, the prevalence of a 7% gross spread, continues today would be a relatively novel research topic. However, we are noting that we are not the only researchers that have been currently interested in this area. In the December 2011 issue of the Journal of Finance, Abrahamson, Jenkinson and Jones (2011) looked at the fees charged by investment banks for managing IPOs in the United Stated and in Western Europe. They concluded that an updated examination of the issue shows that the 7% gross spread was becoming even more prevalent in the United States. Whereas the original study of Chen and Ritter (2000) suggested that the phenomena was dominate in the issues of size ranging from $20 to $80 million. They suggest that the practice is spreading and is now very common in issues up to $250 million in size. They point out that although some of the same investment banks dominate both markets, European IPOs were roughly 3% lower than the United States' IPOs. Moreover these fees were more variable and appeared to be falling through time.

Our evidence is consistent with the Abrahamson et al (2011) paper in that with a slightly different data set we find that the 7% gross spread of IPOs remains the predominate paradigm for U.S. IPOs. The data set for Abrahamson is 1,931 U.S. IPOs and 914 European IPOs from 1998 to 2007, which is from the SDC Platinum data set. In their data set, closed end funds, SPACs, ADRs and REITs are excluded. We do not filter the data and we use all the useable observations from the Bloomberg database. Using all of the data points, there does appear to be a small drop off in the percentage of firms abiding by only the 7% terms, but in examining the data we found that some of these occurred in newer types of issues. These new issues are called blank check IPOs. Blank check IPOs involve raising money without a clear purpose for the investment by a "superior" group of investment managers who are sometimes associated with hedge funds. Also, the 7% gross fee was not a common fee involving IPOs in the area of commercial real estate investments.

Abrahamson et al (2011) examined a number of explanations for the convergence of IPO techniques. He categorized the explanation into direct and indirect costs. Direct costs include legal expenses, the cost of retail distribution and research

analysts, or the extent of litigation risk. Indirect costs relate to underpricing of IPOs by underwriters. American legal expenses are higher but the total is merely 20 to 40 basis points and certainly does not explain the difference in the spread. There was some evidence of higher litigation risk in the United States but the magnitude represent just .58% of proceeds and these were likely not paid exclusively by the underwriter. There was little evidence of other differences in direct costs. Underpricing is the amount that stocks rise above the issue price on the first day of trading. It is an indirect cost of issue. Abrahamson et al (2011) wrote that from 1998 to 2007, the underpricing mean was 14% in the U.S. and 9% in Europe while the medium underpricing was 8% in U.S. and 5% in Europe. Hence, higher U.S. fees are not justified since U.S. underwriters have substantial higher underpricing than exists in Europe. Abraham et al (2011) concludes that treatment of expense issues account for only a small fraction of the gap. Moreover, none of the other arguments survived scrutiny. The results seemed consistent with differing levels of competition and strategic pricing. Implicit collusion was a possibility.

Abrahamson et al (2011) did not address the issue of the split and the 7% fees among the various investment bankers which had previously been investigated by Torstila. We examine whether the common 20/20/60 split found by Torstila is becoming more common. A major contribution of our paper is to investigate whether the contractual treatment of the subcomponents of the gross spread is becoming more standardized. Our paper can also be seen as providing additional supporting evidence from a slightly different data set to the general dominance of the 7% spread in the 21st century, which is clearly document by Abrahamson et al (2011). Moreover, it shows that the IPOs contracts are becoming more standardized in pricing in all aspects.

The paper is organized as follows: Section 1 explains the contractual framework of the division of the gross spread, Section 2 explains the data and methodology, Section 3 examines all the results, Section 4 discusses the policy issues and Section 5 contains the conclusions.

Contractual Framework

In order to accomplish an IPO, a number of financial professionals must be engaged and their services need to be carefully coordinated. The investment bankers usually underwrite the issue for a syndicate, which consisting of three groups: 1) a managing group, 2) an underwriting group, and 3) a selling group. The common split of the underwriting fee within these three groups was the topic of the Torstila paper.

The managing group always consists of two parts, one is the lead manager and the other is the co-managers. The managers are in charge of structuring the syndicate. The lead manager is also in charge of the structure of the IPO and the due diligence process. The lead underwriter has the highest responsibility for the IPOs. The services and general project management responsibility result in a managing group of 20% of the gross spread.

Together, the managing group and the underwriting group are called the underwriters. Underwriters make an underwriting commitment for a given number of shares, which appears in the IPO prospectus. The underwriters predict the financial risk for the amount of shares they have underwritten. However, the current practice of book building reduces the de facto underwriting risk to counterparty settlement risk.

The underwriters obtain an underwriting fee of 20% of the gross spread, which they divide among themselves according to the proportion of their underwriting commitments.

The managing underwriter may congregate to a selling group, which obtains a selling concession of around 60% of the gross spread. The investment banks in the selling group simply ask for stock because of their customers' requirements. The investment banks don't have any financial responsibility for the stock which will be sold. The selling concession is split among the syndicate members according to the sales credited to each member.

Data and Methodology

The original data includes all U.S. equity listings in the Bloomberg database between January 1, 2000 and December 31, 2010, which includes all announced IPOs. This amounts to a total of 1,758 IPOs. For the remaining IPOs, a breakdown of the gross spread into management fee, underwriting fee, and selling concession components is not available in 496 cases. Also, 22 further cases are excluded because their three components do not sum up to the gross spread. Therefore, the sample consists of a total of 1,240 IPOs.

We examined the gross spread both through time and by size of issue. Previous research by Chen and Ritter (2000) indicated that the 7% spread had become more prevalent during the 1990s. For offering done through book building he found that 90% of the offerings in the middle size category were 7%. This compared with 25% in the 1985-1987 period. His results are a little skewed by the fact that he eliminates closed end investment funds, REITs, and ADRs. He defined the middle category range as those offering between 20 million and 80 million. Outside this range there was evidence of economies of scale as the level of gross spread was inversely related to the offering size. This cluster in the middle range was what they

referred to as the 7% solution. In order to adjust for the effects of inflation we recalculated the upper range of the middle grouping. This leads to us classifying the middle range as 25 to 100. We break down the offering groups by size into four groups: (1) 0 to 25 million, (2) 25 million to 100 million (3) 100 million to 250 million and (4) over 250 million.

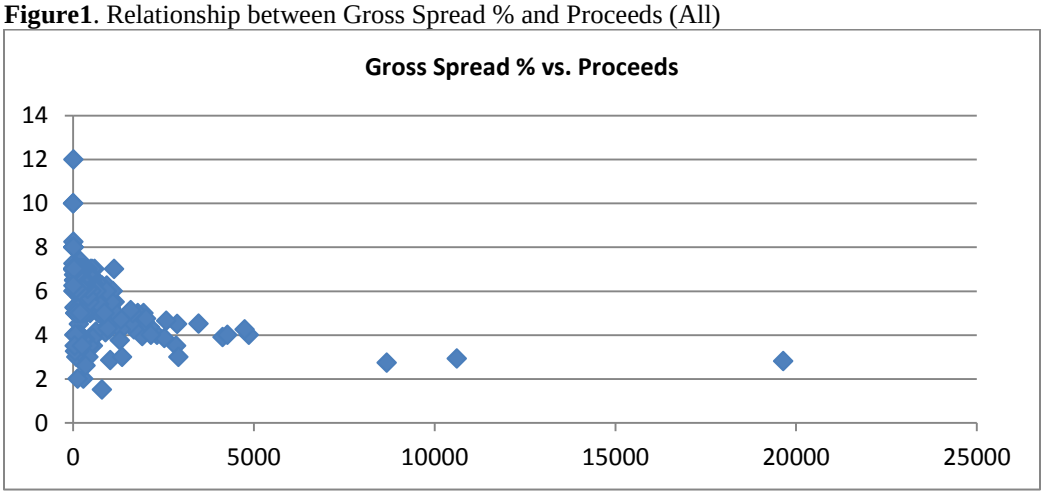
We also examined the split of the underwriter fees through time and by size of issue. Torstila paper found that selling concession increased with issue size. He attributed this to the fact that larger issues are more difficult to sell. Management fees and Underwriting fees were inverse related to issue size. This was said to be related to the fact that the amount of investment banker work in relation to the size of the issue. Investment banker works such as due diligence, writing the prospectus or producing the road show are relatively insensitive to the size of the offering.

Results

Relationship between Gross Spread % and Proceeds

In general, we found the trend between gross spread and proceeds in our data consistent to previous research. Overall the gross spread is related to the size of the proceeds of the IPO issue. Consequently, there seems to be adequate support for the notion that some of the costs, such as assembling the prospectus and developing the road show, in the initial public offering are relatively insensitive to the size of the issue. In Figure 1 and Figure 2, we illustrate the relationship between the percentage of the proceeds representative by the gross spread and proceeds. Figure 1 exhibits gross spread and proceeds of the all 1240 IPOs. We can see the trend that the larger the proceeds, the lower the gross spread %. We also examine the relationship according to the different proceeds amount. We can see that for proceeds lower than 25 million and higher than 250 million, the higher the proceeds, the lower the gross spread %. For proceeds between 25 million and 250 million, the 7% is much more consistent than that of other proceeds amount. Over 250 million there is clearly a strong trend toward lower rates for the gross spread being associated with higher levels of proceeds. Overall, we strong evidence of clustering in the $25-100 million group and evidence of cluster in the $100-$25 million group.

Figure1. Relationship between Gross Spread % and Proceeds (All)



One can see the overall pattern of declining gross spread being associated with larger issue by examining the mean of the groups. The mean gross spread of the entire sample containing all observations is 6.63% with a standard deviation of .84%. This suggests that the 7% gross spread is not the rule. Examining the subgroups shows that the means fall with issue size. For the subdivisions, the means were: 7.49% for the 0-25 million group, 6.91% for the 25-100 million group, 6.79% for the 100-250 million group, and 5.73% for the higher than the 250 million group. Interestingly, the standard deviation forms a U-shaped pattern with the extremes have the larger standard deviations. The standard deviations were: 1.18% for the 0-25 million group, 0.46% for the 25-100 million group, 0.55% for the 100-250 million, and 1.08% for the higher than 250 million group.

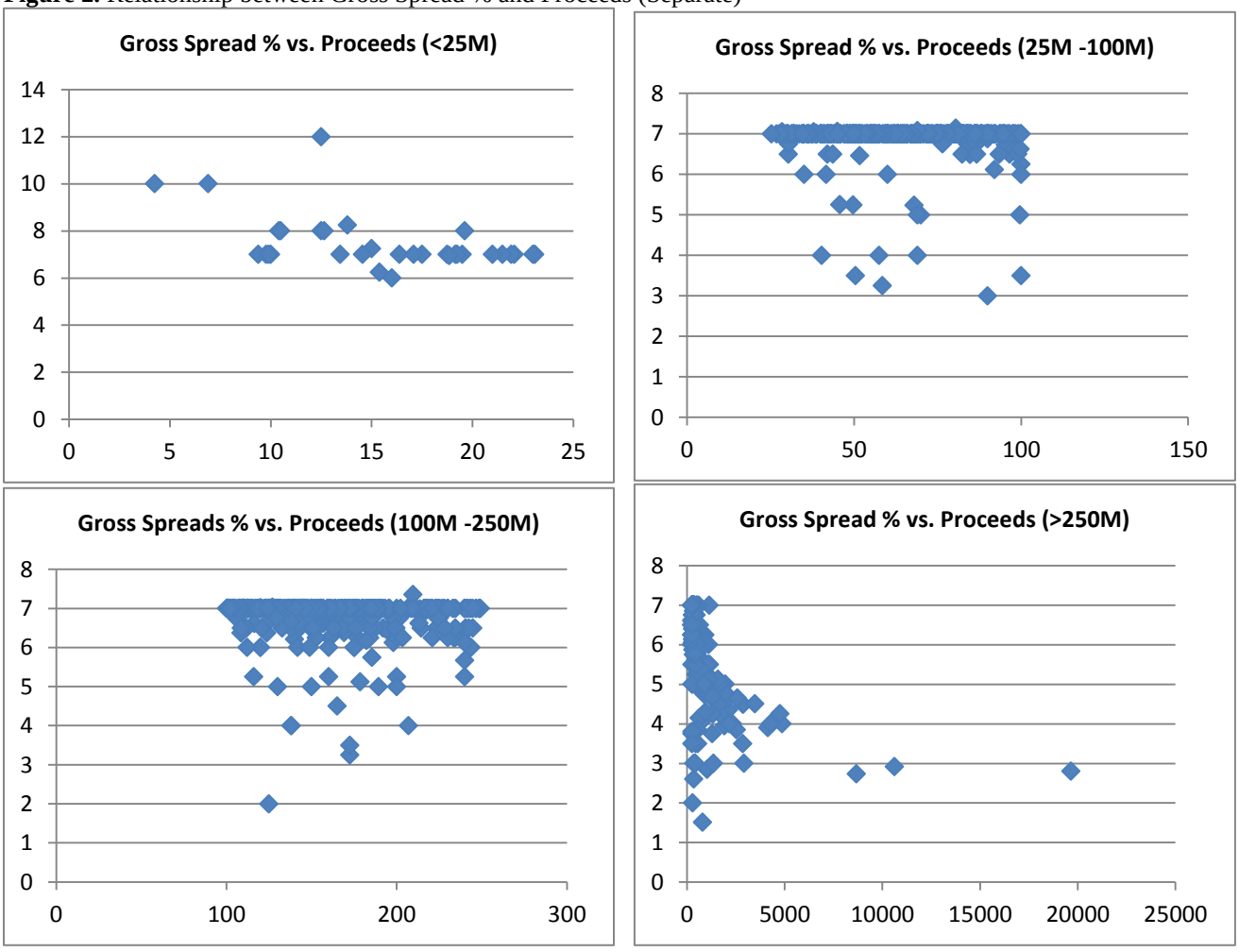
In Table 1, we document using regression analysis the statistical significance of the inverse relationship between issue size and gross spread. The regression analysis documented the clustering phenomena in our data set. We use a piece-meal regression and break up the sample according to the amount of the proceeds of the issue. Overall, one can see that there is a negative relationship between proceeds and the level of the gross spread. The regression coefficient on proceed size is -0.0005 with a t-statistic of -1885. This is to be expected given that there are fixed costs associated with an IPO.

Table 1. Regression Results for Different Proceeds affect Gross Spreads %

	Variable	Constant	Co-efficient	T stat	R Square	Adj. R Square	F
Model 1	All Proceeds	6.7595	-0.0005	-18.852***	0.2231	0.2225	355.4818
Model 2	<25M	9.2775	-0.1154	-3.046***	0.2362	0.2108	9.2790
Model 3	25-100M	6.9783	-0.0011	-1.0664	0.0022	0.0003	1.1372
Model 4	100-250M	7.0444	-0.0016	-2.4843**	0.0144	0.0121	6.1716
Model 5	>250M	5.9941	-0.0003	-8.5676***	0.2169	0.2140	73.4042

***Statistically significant at 1% level; **statistically significant at 2.5% level; *statistically significant at 5% level; #statistically significant at the 10% level

Figure 2. Relationship between Gross Spread % and Proceeds (Separate)



Clustering is documented . In Table 1, the t-stat of the regression using the sample containing proceeds between 25M and 100M shows that the coefficient is not significant, which means there no relationship between proceed size and gross spread fee in this range. The intercept term is 6.97 which is consistent with a "7% solution" in this range. Interestingly, the intercept term of the 100 to 250 million group is 7.04 which is consistent with a dominant 7% contract in this range also. The r-squared of the regression using the sample of proceeds between 100M and 250M shows that the r-squared statistic is just .012. This is an indication of a weaker relationship between the two variables in this range. We content that this evidence is support of clustering in the middle ranges. We feel our evidence is supportive of the contention by the major authors (Chen and Ritter (2000) and Abrahamson et al (2011) that there may be strategic pricing in this range. Our evidence shows a relatively weak

relationship between issue, size and gross fees in 516 out of 1240 observations, which consists of 41.6 % of all the observations.

The 7% Gross Spread Through Time

We examined the prevalence of the 7% gross spread through time. The proportion of 7% gross spread is calculated year-by-year from the sample of 1,240 U.S. IPOs from 2000 to 2010. In Chen and Ritter (2000) it was demonstrated that the 7% gross spread was the dominant pricing term for contracting in the IPOs in amounts range of 20M-80M. They claimed that the incidence had grown from 25% in the middle 1980s to over 90% in the 1990s. We looked at our data to see if this was the case in our more recent Bloomberg data set. For simplicity we break the sample into two groups according to sample size: 25 million to 100 million to compare with the Chen and Ritter's study and a group consisting of all issues with proceeds greater than 100 million.

One can see that the general dominance of the 7% clustering in middle sized IPOs remains dominant through time. Figure 3 shows the gross percentage of the issues that trade at a 7% gross spread from 2000 to 2010. We can see in Figure 3 that for 7 of the 10 years over 80% of the deals have a 7% spread. In should be noted that our data is not screened so that closed end funds, REITS and ADRS are included. So the conclusion is that 7% is dominant is not affected by any data manipulation. Larger deal show less of a trend, Figure 4 shows the less prevalence of 7% gross spread with proceeds of over 100M over years. This is evidence that larger issues are increasingly being done on terms of other than 7%.

For the IPO size between 25 million to 100 million, the 7% gross spread changed from 95.7% in 2000 to 90.0% in 2010. For the IPO size larger than 100 million, the 7% gross spread changed from 63.3% in 2000 to 43.3% in 2010. From the results above, we can say that the IPO with amount between 25 million to 100 million has a high percentage of 7% gross spread compared to those with amount larger than 100 million. Also the percentage of 7% gross spread with 25M-100M changed less than that with larger than 100M. One change in the shape of the curves might be related to a great deal of legal activity in 2001 and 2002 (SEC was investigating the issue of the IPO fees). Another change might be related to the financial crisis which occurred in 2007. They both have the potential to add a strong shock to the IPO market.

Figure 3. The 7% Gross Spread Percentage of 25M-100M

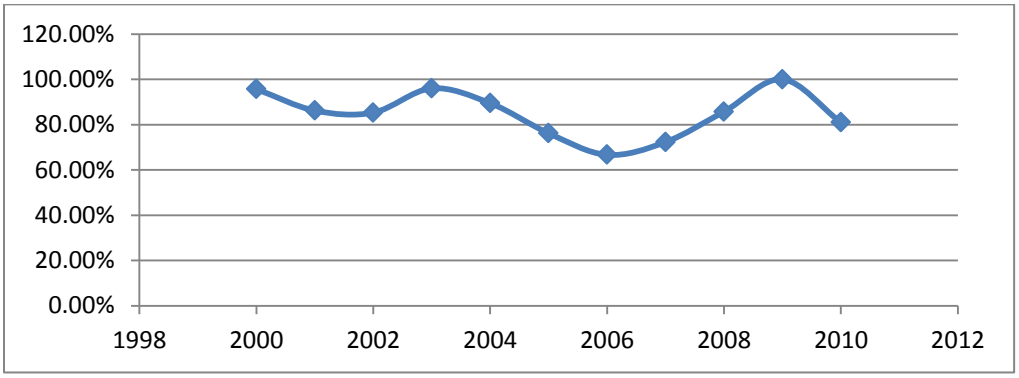
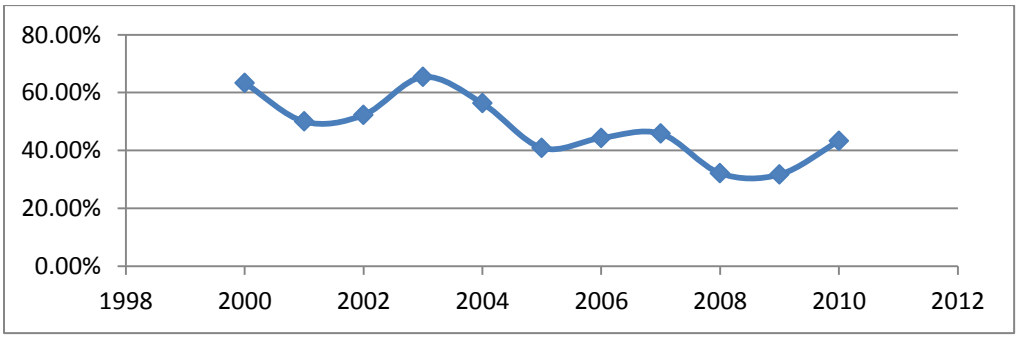


Figure 4. The 7% Gross Spread Percentage of more than 100M



The 20/20/60 Split

This section discusses the frequency and use of the standard 20/20/60 contract, which has become more common over time. When we talk about standard fees and agreements, we always concerned about the degree the competition in the market. The imbalances inherent in standardized contractual practices have long been observed by legal scholars. The typical contract splits the spread into a 20% management fee, a 20% underwriting fee, and a 60% selling concession. This split is widely observed as the industry standard.

According to the Torstila's paper, the proportion of IPOs with precisely a 20/20/60 split has been increasing from 1990 to 1999. Using a rather precise cutoff point for rounding error Torstila found that the proportion had increased from 10% to 36%. Although it is difficult to tell from the text of the article, we assume that one allows a degree of rounding error the proportion was higher. Rounding has a substantial effect on the conclusions as to the magnitude of the standard split. Using absolute no rounding we found that 216 IPOs in the total sample (17.5%) show an exact 20/20/60 fee split, which is higher than the 7.2% stated in Torstila's paper. The results are reported in Table 2. Rounding of the components should be regarded as an issue. As Torstila's paper argues, rounding is a limited phenomenon. If we round the components to the nearest 0.1%, 594 IPOs (47.9%) obey the 20/20/60 split; but rounding to the nearest full percentage point, 891 IPOs (71.9%) show a 20/20/60 split. Table 2 shows the frequency of the standard split (20% management fee, 20% underwriting fee, and 60% selling concession) for a sample of 1,240 U.S. IPOs from 2000 to 2010 using different rounding procedures. Allowing up to a 1% difference for rounding, we examine the frequency of the standard split from 2000 to 2010. We get 65% in 2000 and 70% in 2010 when we round it with 19%-21% for underwriter fee and management fee, and 59%-61% for selling concession. So more than two thirds of all IPOs is the 20/20/60 split. We also sort the data with no rounding, where the percentage fluctuates in the range from 7.25% to 25%.

Table 2: Frequency of the 20/20/60 Split

Frequency of the 20/20/60 Split		
Rounding System Used	No. of 20/20/60 Observations	% of Sample
No Rounding	216	17.5%
To the Nearest 0.1%	594	47.9%
To the Nearest 1%	891	71.9%

20/20/60 Through Time

We examined the incidence of the 20/20/60 split through time. The conclusions are clouded by the issue of rounding. Although not strongly statistically significant because of small sample, one can see a rising trend in the use of the 20/20/60 split through time when we allow round to the nearest full percent. This is shown in Figure 5, but the issue is not clear cut. Looking at Figure 5 we can see a trend rising from 65% to 70% allowing round to the nearest one percent but the results with no rounding are not as clear. The no rounding results are shown in Figure 6. Since it often impossible to get exact splits due to limited divisibility of dollars, we think that the Figure 5 better reflects the intent to insure approximately a 20/20/60 split. It is interesting to note as shown in Table 2 below that in our overall sample we are much closer to this split than Torstila was.

Figure 5. The 20/20/60 Split from 2000 to 2010 with Full Percentage Point Rounding

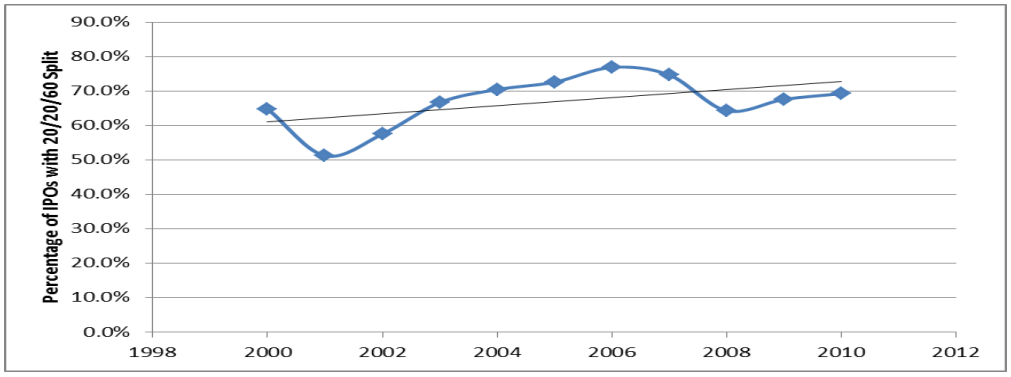
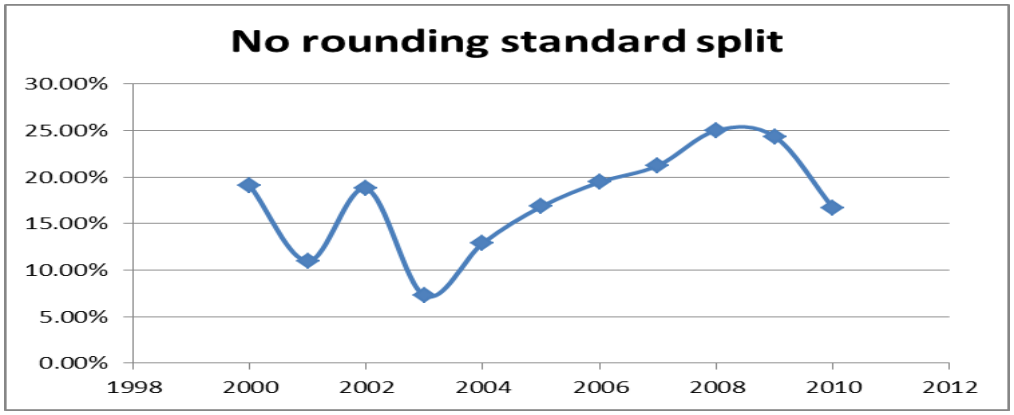


Figure 6. The 20/20/60 Split from 2000 to 2010 without Rounding



The Three Components

Torstila examined the components of the split from 1990 to 1999. The three components are management fees, underwriting fees and concessions. In Torstila's paper, Torstila divided the sample by size to determine if the magnitude of these fees is related to the size of the offering. He finds the proportion of the selling concession increases with gross IPO fees; and the management and underwriting fees decrease with gross IPO fees. Table 2 shows our results which can be compared and contrasted with Torstila. The table shows means and standard deviations of the management fee, underwriting fee, and selling concession (as a percentage of the gross spread) for size subsamples and the total sample of 1,240 U.S. IPOs in the 2000s. Our results are closer to 20/20/60 split than Torstila's. Our mean of average management fee is 20.6% compared to Torstila's 20.8%. Our mean average underwriting fee is 20.1% compared to Torstila's mean of 21.8%. Our mean of average selling concession is 59.3% compared to Torstila's mean of 57.4%. This shows a dominant movement toward the 20/20/60 pattern. In this paper we will examine the updated information in the next 11 years to see the trend in the degree of competition in the marketplace and what drives these results. In our data set, though, in most years (from 2000 to 2006) the selling concession increases with gross IPO fees, but from 2007 to 2010, it decreases, which drives the overall selling concession decreases with gross IPO fees. Similar situations happened to the management fee as well. There is no relationship between size and management fee in our data set. The overall relationship between size and underwriting fee is negative, which is consistent with the result of Torstila's paper.

The disappearance of a clear effect of size of issue (which was found by Torstila) on the division of fees might be the result of a general movement to a 20/20/60 contract at all levels. Our means of each group are closer to the standard 20/20/60 split than those of Torstila. Another might be a large variation of sample sizes from year to year. For example, in 2000, we have about more than 300 IPOs while in 2008, we only have less than 30. We noticed large changes in the direction of the signs after 2007, the date of the financial crisis, but the trend is not statistically significant.

Table 3: Management Fee, Underwriting Fee, and Selling Concession Split

	Average Management Fee (%)	**Average Underwriting Fee (%)**	**Average Selling Concession (%)**	**N**
All Observations	20.600%	20.119%	59.285%	1240
	(3.386%)	(2.398%)	(3.644%)	
By Total Gross Fees:				
Group 1(Smallest)	20.758%	20.915%	58.349%	309
	(2.937%)	(2.973%)	(3.564%)	
Group 2	20.135%	20.191%	59.679%	310
	(0.804%)	(1.362%)	(1.486%)	
Group 3	20.453%	19.892%	59.617%	310
	(3.654%)	(2.780%)	(4.029%)	
Group 4（Largest)	21.053%	19.485%	59.489%	311
	(4.783%)	(1.895%)	(4.577%)	

Standard deviations are in parentheses. Others are averages.

When the IPOs are grouped into quartiles according to size (measured by total gross fees), it is obvious that the selling concession does not clearly increase with gross IPO fees. We examined the data and found a change in the pattern after the financial meltdown. From 2007 to 2010 it the relationship is inverse, which drives the overall selling concession/size of gross fees relationship more negative. . Similar situations happened on the other two fees as well. When we include the years after the financial meltdown, the relationships are not as stable Generally, the relationship between the management fee and issue size is nonexistent and the relationship of issue size and underwriting fee is decreasing.

We examined the distribution of the components. First the mean of each is closer to the standard 20/20/60 split than it was during the 1990s. There are some similarities. There are still a significant proportion of IPOs with a selling concession below 60% (and management fees and underwriting fees above 20%), but relatively few with an underwriting fee below 20%. For the selling concession, the characteristic mentioned in Torstila's paper, a level of proximately 60%, still exists. The actual level in Torstila's paper of selling concession was 57.3% (compared to our result of 59.3% in our paper). Torstila said that 50% is a popular selling concession and most IPOs have selling concession between 50% and 60% inclusive, but selling concessions below 50% also occur.

Policy Issues

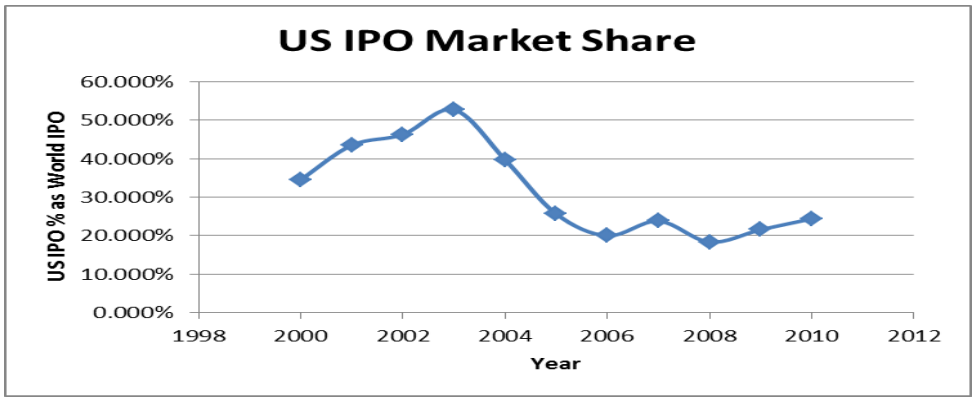
Evidence of anticompetitive practices should make this a possible case for antitrust litigation. However, in Credit Suisse Securities (USA) LLC, fka Credit Suisse First Boston LLC, et al., *v.* Glen Billing, 551 U.S. 264 (2007) the Supreme Court ruled that IPOs were not subject to the antitrust laws. The case involved groups of buyers of IPOs who had filed an antitrust lawsuit against underwriting firms of the IPOs. The purchaser claimed that the underwriters conspired with one another to not sell shares of a popular new issue to a buyer unless the purchaser agreed to certain conditions. These conditions included: buying additional shares of the issue at an escalated price, paying unusually high commissions on subsequent security purchases from the underwriters and purchasing other less desirable securities from the underwriters. These activities were arguably clear violations of the antitrust laws. However, the Supreme Court ruled that the SEC has full regulatory authority over these practices and that the SEC has actively exercised that authority. In instances where there exists explicit regulation of an activity, the Supreme Court said there is an implied preclusion of the antitrust laws to that activity.

Many in modern finance believe that the markets can essentially regulate themselves. Prior to the financial meltdown, this idea was gaining popularity in Congress and a number of legislative initiatives under the guise of deregulation gained traction. The issue has clearly been rethought in the light of the financial meltdown. In the mean-time, the problem here is that the SEC is not regulating the gross spread on the IPOs, but this issue is still not subject to the antitrust laws because of the supreme courts deference to the SEC in regulating this area.

We believe that there are two legitimate policy paths. Either the issue should be subject to the antitrust laws or the SEC should directly regulate these fees. Currently it seems we have to ask the question, "Who is minding the store?"

The continuing prevalence of the 7% gross spread and the standard 20/20/60 split is in stark contrast to the lower fees and greater variability found in the European IPO market and other region around the world. Has the effect of the standardized contract had an effect on the IPO marketplace? If the U.S. produces a less than ideal competitive environment we would expect to see the U.S. share of the world IPO market declining. We used data from Bloomberg to examine the share of the U.S. in the world IPO market. In Figure 7, we can see the obvious trend that the U.S. IPO as a percentage of world IPOs has a downward trend over years. The market share declined significantly from 52.8% in 2003 to 20.0% in 2006. Before 2003, the trend is upward sloping. After 2006, it has been keeping at a low level. Figure 7 shows the decreasing U.S. IPOs market share over time. The market share is calculated as the percentage of the World IPOs from 2000 to 2010.

Figure 7. U.S. IPO Market Share as a Percentage of World IPO



European fees remain lower than U.S. fees. Currently European IPO gross spread fees are approximately 3% lower than in the U.S. If U.S. charged European fees, the issuers would save about a billion a year. This indicates that U.S. is losing market share. Its anticompetitive practices may cost U.S. in the long run. Evidence from Bloomberg indicates that the U.S. is losing market share in IPO issues. To keep competitive to the world market, the U.S. IPO market should take steps to become more attractive. One step could be to more aggressively negotiate the gross spread in IPOs. However, some could argue that the loss of U.S. market share is due to Sarbanes-Oxley's increased reporting requirements, not a noncompetitive price for the IPO services.

Conclusions

Standard terms continue to play a dominate role in IPOs fees .Fees have continued to cluster. The gross fee in an IPO are correlated with IPO size but there is very strong clustering at the 7% level in the middle ranges and the standard 20/20/60 split has become even more common. The research of 1,240 U.S. IPOs shows that, even after allowing for effects of rounding, more than two-thirds of all IPOs follow the standard split of a 20% management fee, a 20% underwriting fee, and a 60% selling concession. The percentage of 7% standard gross spread in the middle size offerings has not ended and continued in 2000s. Similarly, the split has become more standardized. The percentage of deal using the standard split grew from 65% in 2000 to 70% in 2010. Trends in the components of the split appear to have been weakened. No longer do we find a clear direct relationship between issue size and selling concessions or a clear inverse relationship between management fees and issue size. We attribute this to an overall migration to a straight 20/20/60 split and changes in the dynamics of the marketplace after the financial meltdown. We predict that the 7 percent spread clustering and the 20/20/60 trend will continue unless the market or government takes steps to change it. The 7% high gross spread compared to the rest of the world may be resulting in the declining U.S. IPO market share. This is an indication that regulators need to confront these issues sooner rather than later.

Acknowledgements

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