Are There Economies of Scale in Underwriting Fees? Evidence of Rising External Financing Costs

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This study examines the behavior of spreads paid in firm underwritten seasoned common stock offerings and straight bond offerings. Estimates indicate that up to 85% of the spread is variable cost and that the marginal spread is rising. Further, offerings that are likely to require greater underwriting services encounter higher marginal spreads. These findings are consistent with there being a family of U-shaped spreads, with lower quality offerings priced on higher spreads, unlike the economies of scale view of spreads. They agree with the views that underwriters provide valuable services and that the marginal cost of external finance is rising.

In this article we address an important discrepancy between the received wisdom about the underwriter spread and the view of the spread from theories of underwriting. The spread is the compensation paid to the underwriter for selling the firm's security issue, as a percent of the capital raised. The received wisdom is that there are important economies of scale in the issuance of new securities, an idea that is buttressed by many studies and panel data which show that larger issues have lower spreads than smaller issues.[1] Theories of underwriter certification, monitoring, and marketing suggest there are rising costs for these services, and thus that we should also observe many issuers that finance in the region of scale diseconomies in the spread.

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[1] The received wisdom is found in many empirical studies and in leading textbooks used to educate students and practitioners how to raise capital. Economies of scale are reported in SEO spreads [Smith (1977), Bhagat, Marr, and Thompson (1985), Bhagat and Frost (1986), Booth and Smith (1986), Eckbo and Masulis (1991), Hansen and Pinkerton (1982), Hansen (1988), Lee, Ritter, and Zhao (1996)]; municipal bond spreads [Kessel (1971), Benson (1979)]; and in corporate bond spreads [Ederington (1975a, b), Sorensen (1979), Blackwell and Kidwell (1988), Allen, Lamey, and Thompson (1990), Lee et al. (1996), Jewell and Livingston (1998)]. Textbooks reporting that spreads are lower for larger offers include Brealey and Myers (1996), Brigham and Gapenski (1997), Grinblatt and Titman (1998), and Ross, Westerfield, and Jaffe (1999).

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We maintain that evidence of decreasing spreads is misleading and is generated by the fact that larger firms, which tend to have larger issues, have lower monitoring, certification, and marketing costs per dollar of new capital than do smaller firms which tend to have smaller issues. While this does not imply scale economies in the spread, it does suggest that spreads in panel displays of various issuers will inevitably appear to be decreasing as issue size increases. That such evidence is misleading can be seen from the Table 1 seasoned equity offering (SEO) spreads, whose 6.32% mean for $15 million falls to 4.37% for $150 million. This looks like economies of scale, whose "larger is cheaper" prescription tells the firm seeking $15 million at 6.32% that it can raise $150 million at 4.37%. However, although the cheaper spread may be plausible for a

Table 1
Mean underwriter spreads and other characteristics of industrial common stock offers, 1990–1997

Panel A. Underwriter spreads

Proceeds ($ millions)	Number of issues	Mean spread (%)
$10 to $20	230	6.32%
$20 to $30	228	5.83
$30 to $50	326	5.49
$50 to $80	267	5.10
$80 +	274	4.37
All	1,325	5.38%

Panel B. Offer Years and other characteristics

Year	Number of issues	Characteristic	Mean (median)
1990	46	Equity value	$429
1991	122		($193)
1992	95	Proceeds	$59
1993	157		($41)
1994	106	Volatility	3.60%
1995	207		(3.43%)
1996	243	Primary equity	$9,614
1997	205		($9,130)

The sample of SEOs was obtained from the Securities Data Company (SDC), and consists of industrial firms' offerings (those with SIC classifications other than 400s or 600s) during the January 1990 to December 1997 period. Excluded are rights offerings, unit offerings, and offerings by the same issuer that are within 30 calender days of each other. Also deleted are very small and very large issues (those under $10 million or over $1 billion in proceeds). The issuer must be listed on CRSP for 260 business days before the offering to obtain a daily stock return standard deviation, and have accounting information on COMPUSTAT for the most recent fiscal year ending before the offering. Underwriter spread is total compensation paid to the syndicate, as reported on the offering prospectus, expressed as a percentage of the proceeds. Proceeds, as reported on the offering prospectus, exclude funds raised by the exercise of overallotment options. Equity value is number of shares outstanding times the price of common stock taken from CRSP as of one day before the offering. Stock return volatility is the issuer's stock rate of return standard deviation, estimated from daily returns during the 220 trading day period ending 40 days before the offering date. Primary equity is the aggregate value of all industrial underwritten equity financing during the three months leading up to the stock offering. All monetary variables are measured in January 1990 dollars using the Consumers Price Index as a deflator.

$1 billion market capitalization firm, it is implausible for a $50 million firm. Such evidence also seems to confirm the idea that most of the underwriter expenses are fixed cost, yet we suggest that this too is a deception caused by pooling various issuers. To see that fixed cost may in fact be small, consider the total cost of the $15 million, $948,000 (= $15,000,000 × 0.0632) as a generous upper-bound estimate for fixed cost. Yet the total cost for the $150 million exceeds the estimated fixed cost by $5.6 million.

Despite the widespread evidence of falling spreads, underwriting theories suggest the issuer's spread should be a U-shaped function of the amount of new capital raised. Initially, fixed cost causes scale economies, but as issue size increases diseconomies of scale emerge in the spread due to rising placement cost. Placement cost increases because adverse selection problems expand and so do potential agency problems, and because finding more buyers willing to buy the offer at the offer price becomes more difficult. Thus more capital beyond some amount entails rising costs of underwriter certification, monitoring, and marketing, which increase the spread.[2] Diminishing returns in service production also fuel the diseconomies of scale. Consistent with these predictions, our evidence indicates that the actual cost curve is U-shaped.

Our investigation focuses on answering four questions. First, are underwriters' fixed costs large? Finding a large variable component diminishes the fixed cost rationale for scale economies. It is what we should expect if the syndicate, the group of underwriting investment banks, produces expensive financing services. Second, is the marginal spread increasing in the proceeds? If it is increasing then diseconomies are possible. Third, is the marginal spread higher for issues requiring more service? Higher agrees with our view that lower quality issuers will face higher U-shaped spreads. And last, how frequently do firms raise capital in the range of diseconomies of scale in the spread? Based on underwriting theory of syndicate monitoring, certification and marketing, we should expect that many issuers finance in the diseconomies range.

We examine spreads on 1,325 SEOs from 1990 through 1997. Our estimates indicate that fixed cost is no more than 10% of total fees, on

[2] For discussion of the certification service and supporting evidence see Beatty and Ritter (1986), Booth and Smith (1986), Carter and Manaster (1990), and Chemmanur and Fulghieri (1994). Easterbrook (1984) and Hansen and Torregrosa (1992) discuss the monitoring function and Hansen and Torregrosa (1992) provide supporting evidence. The need for marketing has been emphasized by Kraus and Stoll (1972), Miller (1977), Hansen and Pinkerton (1982), and Merton (1987). Its importance is evident by tools used in the syndication process. One is the "road show" in which investment bankers go on the road to market the securities to investors. See Pratt, T., "On the Road Again," 1993, *Investment Dealers Digest*, September, 14–19. Others include territorial restrictions in the sale of the international tranche of global security offerings, and the use of the overallotment option in many SEOs.

average. This is consistent with the conclusion that underwriter costs are mostly variable. Further, the estimated marginal spread, $51,488 for an additional million dollars, is increasing by $300 for an incremental million, for the typical issuer. We report further that smaller firms encounter steeper marginal spreads per dollar of proceeds. Multivariate analyses also indicate that marginal spreads are higher for more volatile stock, and in more active primary markets. These findings are consistent with higher marginal spreads when more capital-raising services are needed. Additional findings show that smaller issues tend to have higher U-shaped spreads than larger issues have. This agrees with our reconciliation of the popular wisdom with underwriting theories. Finally, our estimates show that 40% to 50% of the issues are in the scale diseconomies range of the spread.

We extend our investigation to 628 bond offerings. Although their spreads are lower than SEO spreads, on average, they will be U-shaped if bond issues have large variable cost. Regression estimates indicate that bond spreads have large variable cost. Further, their marginal spreads are rising, and more so for smaller issuers, and are higher for riskier bonds. They are also higher in busier primary bond markets. We find that many bond issues are in the range of scale diseconomies in the spread. These findings complement the SEO evidence.[3]

The article proceeds as follows. Section 1 discusses the cost-based theory of the spread. Section 2 reports the results of an examination of equity offering spreads. Section 3 reports results from an analysis of bond offering spreads. We conclude in Section 4 by noting how our findings provide empirical support for the view that external financing cost is rising.

1. Two Perspectives of the Spread

Panel A of Table 1 reports the mean spread paid by sample firms, by proceeds categories of roughly comparable numbers of offerings. It shows that the spread falls monotonically as proceeds increase. As we have noted, it is often concluded from such evidence that there are economies of scale in the spread. Here we discuss the economies of scale view and contrast it with the view that there are several U-shaped spreads.

[3] In a prior version we examined SEOs from 1972 to 1986 from the Security and Exchange Commissions' *ROS* tape and *Investment Dealers Digest's Corporate Financing Directory*. The conclusions reported here are qualitatively similar to the conclusions reached from that examination.

1.1 A cost theory of the spread

Our discussion abstracts from the processes of lead bank selection, syndicate formation, and negotiation with the issuer, and takes a "black box" view of the syndicate as a producer of proceeds. It assumes that investment banking competition is sufficient enough to ensure that underwriter fees represent the cost of underwriting the offer. Empirical and anecdotal evidence is consistent with the view that banks may compete up until the eleventh hour to lead most syndicates.[4] We do not require that issuers choose the amount of capital solely to minimize their underwriting expense on that offering. The amount of capital raised by the firm may accommodate a variety of other considerations including investment opportunities, liquidity, expected future cash flows, other planned financing, and capital structure objectives. However, we assume that issuers are "price-takers" with respect to the spread.

The syndicate's costs contain a fixed cost that is the same for each offering. It includes state and federal taxes and fees, expert fees, SEC registration fees, and other setup expenses that are independent of issue size. These may include a portion of bank overhead expenses that fund research staff to include the reports of analysts, syndicate departments to include their prospectus production and distribution, and expenses for basic legal and litigation activities. For a given firm, the syndicate's remaining variable costs are likely to be increasing, as more underwriting services are required as more proceeds are raised. More intensive effort may expand service output well into the region of diminishing returns. And a broader application of services and effort, which may be more likely in more active primary markets, can cause upward pressure on service costs. Of course, some offerings may be in the range of a falling variable spread. For example, the services needed for a small offering by a widely held firm may yield increasing returns so that average costs are falling, exhibiting economies of scale.

[4] Major banks appear to compete for ample deal flow. In 1996, for example, there were 32,694 syndicated equity and fixed income offers or 148 deals per business day (domestic, municipal, Eurobond, and worldwide, *Investment Dealers Digest*, January 13, 1997), and 26,587 or 213 deals per day in the first half of 1998 (*Investment Dealers' Digest*, July 6, 1998). The high deal flow can discipline banks to behave reputably. Beatty and Ritter (1986) report evidence that reputable banks receive greater future deal flow and poorly performing banks receive deal flow reduction. Eccles and Crane (1988) report evidence of competition through informal auctions in the preoffering period. The business press reports other anecdotes of late-round competition. For example, Time-Warner first chose Merrill Lynch to lead its equity syndicate but, with just days left before the offer was to begin, switched to Salomon Brothers ("How Salomon Muscled Aside Merrill to be Lead Underwriter on Big Rights Offering," *Wall Street Journal*, July 19, 1991, p. A6). Next Wave Telecom Inc. switched from Merrill Lynch to Smith Barney to lead its IPO (*Investment Dealers Digest*, March 3, 1997, p. 17). And Merrill Lynch edged out in preoffering competition other major banks in the Matav IPO, Hungary's national Telecommunications Company (*Investment Dealers Digest*, January 13, 1997, p. 13). For analyses of the negotiated and competitive bid contracts see Hansen and Khanna (1994) and see Giamarino and Lewis (1988–89) for a discussion of the negotiated contract.

1.2 Economies of scale and U-shaped spreads

More formally the spread is total cash compensation paid to the underwriter, *fee*, relative to the gross proceeds, P,

$$spread(P) = \frac{fee}{P}, \tag{1}$$

which we write as the sum of the fixed and variable costs

$$spread(P) = \frac{K}{P} + vspread(P), \tag{2}$$

where K is fixed cost and $vspread(P)$ is the variable cost per dollar of proceeds.

The marginal spread, $mspread(P)$, is obtained by multiplying the spread by proceeds, thus obtaining the total fee, and differentiating the fee with respect to the proceeds,

$$\begin{aligned} mspread(P) &= \frac{\Delta fee}{\Delta proceeds} = \frac{\partial [spread(P) \times P]}{\partial P} \\ &= \frac{\partial [vspread(P) \times P]}{\partial P}. \end{aligned} \tag{3}$$

Spread behavior is found by differentiating Equation (2) with respect to proceeds,[5]

$$\frac{\partial\, spread(P)}{\partial P} = \frac{mspread(P) - spread(P)}{P}. \tag{4}$$

Equation (4) depicts a potential trade-off between the decline in the syndicate's average fixed cost and an increase in its average variable cost. There is thus no a priori reason to rule out that some issuers will experience scale economies, while others will experience diseconomies.

However, under the popular view that economies of scale predominate, the spread is falling and this is what is evident in panel data. From Equation (4), a falling spread implies that the marginal spread must be smaller than the average. This will be the case if fixed cost is a large part of total cost, in which case the spread is predominantly average fixed cost. It will also be the case if the average variable cost is always falling (or rising less than average fixed cost is falling), which is not what is anticipated by underwriting theory.

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[5] Since $spread = \frac{fee}{P}$ and $mspread = \frac{\partial fee}{\partial P}$, then $\frac{\partial spread}{\partial P} = \frac{P\frac{\partial fee}{\partial P} - fee}{P^2} = \frac{mspread - spread}{P}$.

Now the variable cost function is different for different issues due to different levels of underwriter effort. Issues are sorted into their "quality" class, denoted by φ, reflecting the cost differences. The spread is now

$$spread(P:\varphi) = \frac{K}{P} + vspread(P:\varphi). \tag{5}$$

The marginal spread is rising over a relevant range of the proceeds, holding service quality constant,

$$\left.\frac{\partial\, mspread(P:\varphi)}{\partial P}\right|_{d\varphi=0} > 0. \tag{6}$$

Spread behavior for an issue of given quality is given by

$$\left.\frac{\partial\, spread(P:\varphi)}{\partial P}\right|_{d\varphi=0} = \left.\frac{mspread(P:\varphi) - spread(P:\varphi)}{P}\right|_{d\varphi=0}, \tag{7}$$

which is U-shaped as the marginal spread moves above the spread.

Now the marginal spread is higher for more services, ceteris paribus,

$$\left.\frac{\partial\, mspread(P:\varphi)}{\partial \varphi}\right|_{dP=0} < 0, \tag{8}$$

where higher φ means higher quality.

Thus Equation (5) depicts a U-shaped spread "curve" for each issue quality, with a lower spread curve for higher issue quality. That is, between two offerings that differ in quality yet raise the same amount of capital, the firm issuing the higher quality security will pay a lower spread than the firm issuing the lower quality security. Nevertheless, both firms face marginal spreads that may rise at different rates. Under the assumption that issue quality improves with firm size, larger firms will tend to face lower variable cost, and thus lower U-shaped spreads.

Since firms are not likely to choose proceeds to minimize their spread, we expect that some issues, at the margin, will experience economies of scale in the spread and others will experience diseconomies of scale. To reconcile this prediction with panel displays of spreads, we suggest that there is a confounding effect in the spreads. We now discuss this confounding effect.

1.3 A graphical interpretation

From an empirical perspective, the ability to detect the presence of several mixed U-shaped spreads (henceforth a spectrum of spreads) centers on how the spread-proceeds relationship is specified. Studies that report evidence consistent with economies of scale frequently specify a spread-proceeds relationship that will not allow the fitted spread curve to be U-shaped, nor do they allow that there may be different marginal spread slopes for different types of issuers. The specification often results in pooling offerings into a common spread-proceeds relationship (e.g., a percentage spread that is linear in the logarithm of proceeds), inducing the image of economies of scale, just as a panel display of spreads does. In contrast, the spectrum view calls for a spread-proceeds specification that allows the variable cost slope to differ with issue quality. When these conditions are allowed in the specification, then one can test the hypotheses that the spread is U-shaped and that the marginal spread slope differs by qualitative factors.

The differences between pure economies of scale and spectrum views are displayed in the scatter plot of hypothetical offerings and their spreads in Figure 1. Panel A depicts the economies of scale specification, where the regression line ES was fitted to the entire sample. The ES model suggests economies of scale and the following interpretations. (i) A firm that chose allocation **a** can expand its offer to the amount as at **v** and pay the lower spread at **v**. (ii) In general firms can expect to

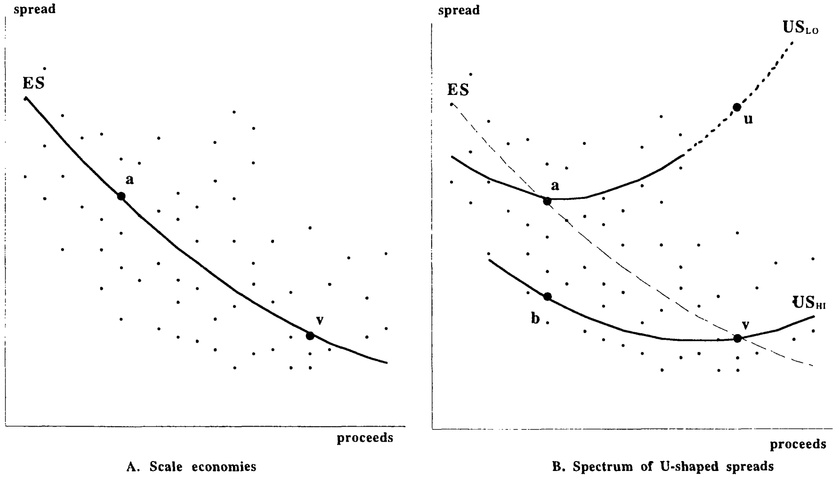

Figure 1
Two interpretations of spread data
The figure depicts hypothetical underwriter spreads on the vertical axis against their associated offering proceeds, measured along the horizontal axis, and fitted spread curves. **ES** denotes a convex spread curve fitted to the data, and represents the economies of scale view. $\mathbf{US_{LO}}$ and $\mathbf{US_{HI}}$ portray two different U-shaped fitted spread curves representing the spectrum of spreads view, where the higher (lower) curve LO (HI) is lower (higher) quality issuers. Points **a**, **v**, **b**, **u**, and the small bullets denote particular spread-proceeds allocations.

incur the same spread at each proceeds level along the fitted spread schedule.

Panel B depicts the spectrum specification where the estimated model was fitted to the same hypothetical offerings and spreads, and the model allows for various U-shaped spreads and marginal spreads (not shown). Two of the U-shaped curves are highlighted. US_{LO} is for issues requiring a lot of service (lower quality) and US_{HI} is for issues that require fewer services (higher quality). US_{HI} is "southeast" of US_{LO} because of the assumption that higher quality issues tend to be from larger firms, which have larger offerings, all else the same. However, firms face a U-shaped spread and a rising marginal cost of capital within their quality class. The spectrum perspective gives rise to very different prescriptions than the economies of scale view. (i) Consider the LO-type firm at allocation **a** that wants instead the same proceeds as at **v**. This firm will have to pay the higher spread at **u** along its curve US_{LO}, incurring a higher and rising marginal cost of underwriting. In the case of US_{LO} the marginal cost is so steep, reflecting the unusually large relative offer size, that no other LO-type firm has attempted to undertake such a large offering. Therefore, confronted with this equilibrium schedule of spreads, this firm cannot expand its proceeds by such an amount and expect to incur a lower cost, unlike the economies of scale prescription. (ii) A HI-type firm allocation **v** that instead wants the same proceeds as at **a** will not have to pay underwriters the higher spread allocation **a**, and will pay the much lower spread at **b**. (iii) In general firms face different U-shaped spreads.

Our spectrum view therefore suggests that a confounding effect is present in panel offering data. Larger offerings tend to be issued by larger firms whose issues are of higher quality, and thus have lower placement cost per dollar of proceeds than issues by smaller firms require. Consequently the fact that larger and smaller firms each face U-shaped spreads is confounded when the spreads and proceeds data are pooled in panel form. The same confounding is present in econometric models that do not allow for a spectrum of spreads and pool offerings of different qualities [e.g., Jewel and Livingston (1998)].

2. Common Stock Offerings

The equity issues sample, which is obtained from Securities Data Company (SDC), consists of industrial firms' offerings (those with SIC classifications other than 400s, regulated firms; or 600s, financial firms) during the January 1990 through December 1997 period. Excluded are rights offerings, shelf offerings, unit offerings, and offerings by the same issuer that are within 30 calendar days of each other. Very small and very large issues (those under \$10 million or over \$1 billion in proceeds) are deleted (monetary variables are measured in January 1990 dollars using the Consumers Price Index as a deflator). This yields a sample of 4,615 SEOs. Further, the issuer must be listed on the CRSP for 260 trading days before the offering in order to obtain a daily stock return standard deviation (measured over the 220 trading days ending 40 days before the SDC-reported offer date). The issuer must also have accounting information on COMPUSTAT for the most recent fiscal year ending before the offering. This yields a final sample of 1,325 offerings.

Panel B of Table 1 shows that equity offerings are relatively frequent during the 1990s and more so in the later years. The average market value of common stock at the time of the offering is $429 million (stock price times shares outstanding as reported on the CRSP file), and the average offering size is $59 million.

2.1 The empirical models

Consider first a strong case for depicting the economies of scale view in a simple model in which the spread is linear in the logarithm of gross proceeds and stock return volatility:

$$s = \gamma_0 + \gamma_1 \ln(x_1) + \gamma_2 x_3 + e \tag{9}$$

where s is the spread, x_1 is the gross proceeds, x_3 is "volatility," the percentage daily standard deviation of the issuer's common stock rate of return over the 220 trading days ending 40 days before the offering, and e is the error term.

Under the economies of scale view the proceeds coefficient estimate, g_1, should be negative (throughout, coefficient estimates are denoted in lowercase Latin).

Model 1 in Table 2 reports the simplest estimates for Equation (9). The logarithm of proceeds coefficient is significantly negative. This agrees with the conclusion that there are scale economies in the spread. In model 2 we include stock return volatility to register risk. The addition of volatility significantly improves the fit. Notice, however, that both models only allow that the fitted spread will fall at a decreasing rate, or increase at an increasing rate. They do not allow the fitted spread to be U-shaped in the log of proceeds.

In the spectrum view the spread is modeled as the sum of fixed cost and variable cost. From Equation (5), the separable fixed cost requires that the spread model include the inverse of gross proceeds. The coefficient of the inverse proceeds is the estimate for the fixed cost.

The spectrum view also requires specification of separable variable cost that can be rising over a relevant range of proceeds. To not allow for a rising component would combine any offsetting effects of greater proceeds onto the inverse proceeds coefficient, yielding a result that is

Table 2
Ordinary least squares estimates of spreads paid in common stock offerings (*t*-statistics reported in parentheses)

	Model 1	Model 2	Model 3	Model 4	Model 5	VIF[b]
g_0	8.69	7.31				
	(86.06)	(57.53)				
g_1	−0.88	−0.77				
	(−33.52)	(−30.09)				
b_0			4.04	3.55	3.41	
			(98.82)	(63.16)	(47.78)	
b_1			25.65	22.20	22.55	1.13
			(28.18)	(24.78)	(25.09)	
b_2		0.02	2.64	2.23	2.21	1.07
		(4.89)	(17.01)	(15.03)	(14.85)	
b_3		0.21		0.19	0.19	1.16
		(14.91)		(13.10)	(13.09)	
b_4		2.02[a]			1.51[a]	1.02
		(4.89)			(3.32)	
Number of issues	1,325	1,325	1,325	1,325	1,325	
Adj. R^2	0.41	0.50	0.48	0.54	0.54	
F	1,120	527	615	521	396	

The sample is described in Table 1. Model 1 is $s = \gamma_0 + \gamma_1 \ln(x_1) + e$, where s is the percentage underwriter spread reported on the offering prospectus, x_1 is the gross proceeds from the cover of the prospectus in millions, and e is the error. Estimates of Greek coefficients are denoted in lowercase Latin. Models 3 through 5 are variations of $s = \beta_0 + \beta_1 \frac{1}{x_1} + \beta_2 \frac{x_1}{x_2} + \beta_3 x_3 + \beta_4 x_4 + e$. x_2 is shares outstanding times share price immediately prior to the offering reported on CRSP. x_3 is the standard deviation of common stock rate of return estimated from daily returns during the 220 trading day period ending 40 days before the offering date. x_4 is the value of all firm underwritten equity offerings by industrial firms over the prior three months, as reported on the SDC file. All monetary variables are measured in January 1990 dollars using the CPI as a deflator.

[a]The coefficient b_4 is multiplied by 100,000.

[b]VIF denotes the variance inflation factors for Model 5. VIF equals $1/(1 - r^2)$, where r^2 is from the regression of the independent variable on the remaining independent variables.

likely to be similar to the simple spread model that is linear in the logarithm of proceeds.

A simple specification is an intercept term plus the ratio of gross proceeds to the preissue market value of equity. The ratio has the effect of holding firm size fixed as proceeds expand and thus allows the variable (total) costs of underwriting to increase at an increasing rate. In our models, firm size captures many qualitative differences that collectively suggest that smaller firms may require more services, hence their spreads will be larger.

We have noted a number of reasons why for a given firm the spread should be increasing. However, intuitive support for this notion is not evident in panel data as in Table 1. We thus report Figure 2, which measures spreads on the vertical axis against relative proceeds on the horizontal axis. The sample is sorted into three risk groups (low, medium, and high) based on the volatility of their stock returns and

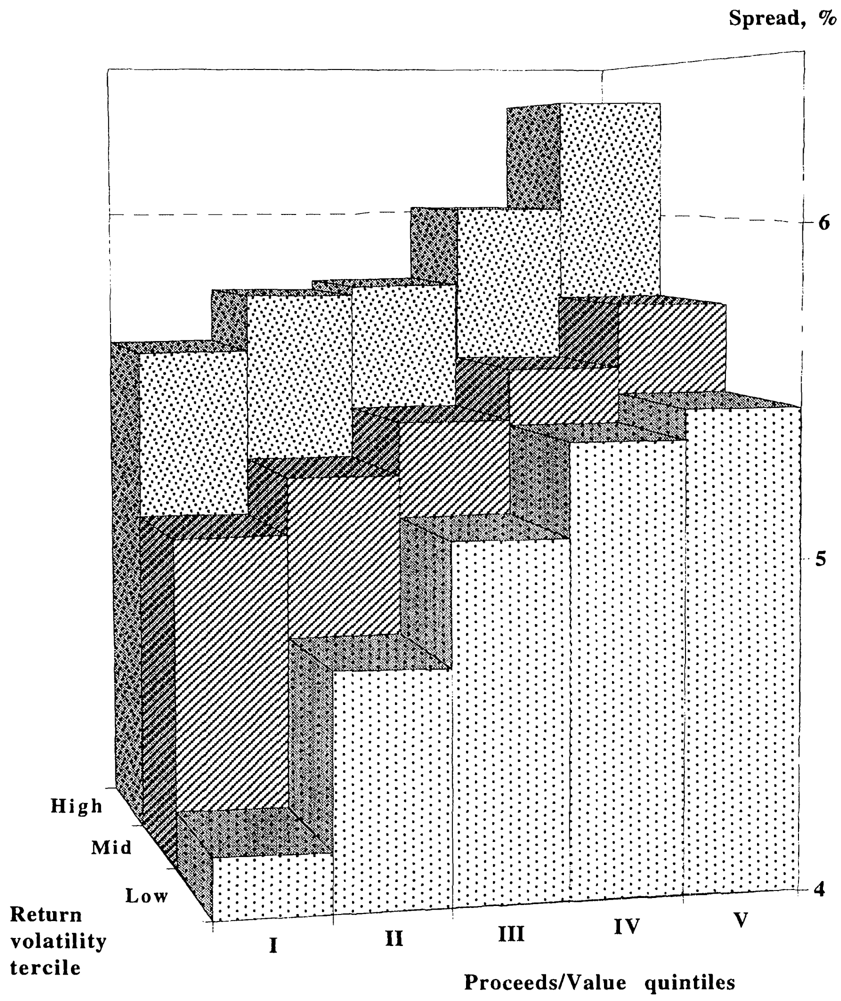

Figure 2
Equity issuers' spreads within volatility categories across sample quintiles of the ratio of proceeds relative to the market value of common stock
The figure presents the mean spread for the sample of equity issuers described in Table 1. The sample is sorted into terciles based on the standard deviation of the rate of return on common stock measured over 220 trading days ending 40 days before the offering, to form the "low volatility," "mid volatility," and "high volatility" categories. The sample is also sorted into quintiles based on the gross proceeds relative to market value of equity, as reported on the offering prospectus, where I is the lowest size quintile and V is the highest size quintile. The figure depicts the mean spread within each of the fifteen categories formed by crossing the volatility terciles and the proceeds quintiles, where the height of the bar is the within category mean spread.

sorted independently into proceeds/(market value) quintiles. Thus the figure depicts the mean spreads across the five proceeds quintiles within each of the three volatility categories. It shows that the spread increases in the proceeds relative to market value within each volatility category, consistent with spreads increasing in the proceeds.

Combining the fixed and the variable costs yields the simple spread model

$$s = \beta_0 + \beta_1 \frac{1}{x_1} + \beta_2 \frac{x_1}{x_2} + e, \tag{10}$$

where x_2 is the market value of equity at the time of the offering.

Due to rising costs of underwriting and diminishing returns in producing the proceeds, the variable spread is expected to be rising in the proceeds, given the firm's size. Hence b_2 should be positive. The discussion has also suggested that the variable spread should be less steep for larger firms, for a given level of proceeds.

Model 3 in Table 2 reports the first estimates of the spectrum view. The estimate of the inverse proceeds coefficient is significantly positive, consistent with the existence of fixed cost. The coefficient of 25.65 represents fixed cost of $256,500 (because spread is measured in percent, and proceeds in millions). The estimated coefficient of proceeds relative to firm value, 2.64, is also significantly positive, consistent with the notion that variable cost is rising as more capital is raised. For example, a $400 million firm that seeks $60 million in gross proceeds will encounter an average variable fee of 4.4% per million dollars raised (= 0.0404 + 0.0264 × $60 ÷ $400). This fee will rise by $1,688 per million, to $45,688 per million, if the firm instead seeks $80 million in gross proceeds. In effect, the firm will encounter a noticeably higher average fee of $50,800 per million on the extra $20 million, because the marginal and average variable spreads are rising. The parameter estimates therefore suggest that for firms of a given size, the spread is U-shaped, due to a trade-off between a falling average fixed cost and a rising average variable cost.

The estimates are also consistent with larger firms having a lower variable cost than smaller firms have for a given amount of proceeds. In the above example, if the company is worth $200 million, then it will have to pay $5,272 more per million dollars in gross proceeds since its average variable fee will be $50,960 per million. This is consistent with smaller firms requiring increased underwriting services per dollar of proceeds.

More than one criteria suggest that Model 3 is superior to Model 2. One can appeal to a goodness of fit comparison that shows that Model 3 has a higher adjusted R^2.[6] Further, we have noted economic theories that prefer a model like Model 3. By contrast, there is no clear prediction from the economies of scale view, other than that underwriter costs include a fixed cost and that the marginal cost does not substantially rise. No less important is that Model 2 is unlikely to reject the economies of scale hypothesis. This inability arises because it is constrained to not fit a U-shaped curve, and is likely to produce a negatively sloped fitted curve if there is even a slight negative relationship between spread and proceeds in the data. Thus Model 2 is unable to reject the alternative spectrum hypothesis. By contrast, Model 3 can reject the null economies of scale hypothesis, and it can reject the alternative spectrum hypothesis, if warranted by the data. Model 3 therefore offers all that Model 2 offers and more.[7]

We next expand the variable cost to include two measures of issue quality, issue volatility, and a primary market activity component, yielding the expanded spread model:

$$s = \beta_0 + \beta_1 \frac{1}{x_1} + \beta_2 \frac{x_1}{x_2} + \beta_3 x_3 + \beta_4 x_4 + e, \tag{11}$$

where x_3 is the "volatility," the percentage daily standard deviation of the issuer's common stock rate of return over the 220 trading days ending 40 days before the offering, and x_4 is the activity of the primary equity capital market, measured at the time of the offer as the total value of industrial equity offerings for the three months leading up to the equity offering as reported by the SDC. Table 1 reports that the average activity was $9.6 billion per three months for the sample period.

A number of studies show that volatility has a significantly positive impact on the spread [Hansen and Pinkerton (1982), Bhagat and Frost (1986), Booth and Smith (1986), Denis (1991), Hansen and Torregrosa (1992)]. This is consistent with several interpretations. It is consistent with the view that the premium paid to underwriters for bearing inventory risk reflects the put-option nature of the firm-underwritten contract. It is also consistent with volatility being correlated with information asymmetry between managers and investors, with investor heterogeneity, and with the need for more monitoring, as it is more

[6] Other goodness of fit test statistics, such as the PRESS residuals (prediction errors), the adjusted PRESS residuals, and the mean square error, produce the qualitatively similar conclusion that the U-shaped specification is a better fit than the linear in the logarithm model, so we do not report them. For discussion of goodness of fit measures see Draper and Smith (1981), Myers (1990), and Maddala (1992).

[7] Adding more of the independent variables to the two models before attempting to choose between them does not alter the conclusion that the spectrum model has better goodness of fit statistics. Nor does the inclusion of additional variables detract from the conclusion that Model (2) has a firmer theoretical underpinning.

difficult to measure managers' effort as volatility increases. Further, to the extent that volatility is correlated with variability of future cash flows, it is consistent with Stulz's (1990) prediction that costs of managerial discretion are higher for more volatile firms. Those firms may thus pay a higher spread due to oversight monitoring and higher expected litigation costs.

Based on the above discussion, for each level of proceeds, more volatility should increase the variable spread, hence $b_3 > 0$. The Model 4 estimates in Table 2 indicate that increased volatility shifts the average variable spread higher. For example, a 15% increase in volatility from the mean, from 3.6% to 4.1%, increases the estimated marginal spread by 0.10%.[8] Notice that the inclusion of volatility has significantly improved the adjusted R^2.[9]

Underwriter costs are also expected to vary with the activity in the primary capital market. Higher financing activity may reflect a "supply effect" induced by cyclical improvement in investment opportunities. Economic expansions are likely to be characterized by better investment opportunities, hence lower adverse selection, and would have the effect of lowering certification costs, inducing downward pressure on the marginal spread.[10] However, higher primary market activity may instead reflect greater investor demand for new issues. This "demand effect" may reflect cyclical changes in the propensity to invest in stocks, perhaps due to increases in wealth or cash availability [Boudoukh and Whitelaw (1993)]. In this case, periods of greater financing activity will induce upward pressure on the spread due to "crowding" in the primary market and rising factor prices. Workload increases in the banks' corporate finance department will make deal completion more difficult, and increases in demand for inputs employed by syndicates may push up factor prices. However, such periods may also be associated with a theoretically offsetting effect if investors are so ebullient to cause a significant reduction in the effort needed to market new securities.

The Model 5 estimates in Table 2 indicate that spreads are higher in busier issuance periods. This is consistent with the views that marketing costs increase in busier financing periods, and that possible benefits of

[8] We also examined volatility measured over other periods around the financing and obtained qualitatively similar results. We examined whether the spread is increasing in the common stock beta, as suggested by Bhagat and Frost's (1986) idea that the risk premium may only require compensation for systematic risk because syndicate banks hold diversified portfolios. However, in results not reported here, beta was found to be insignificant.

[9] The inclusion of an explicit measure of risk also reduces the inverse proceeds coefficient. This is consistent with the idea that the inverse proceeds picks up some of the issue's risk, as smaller offerings are by smaller and riskier firms. Beatty and Ritter (1986) suggest using the inverse proceeds to proxy for IPO risk, at a time when the firm's standard deviation is not observable.

[10] Consistent with this, studies report evidence of reduced price reactions to equity financing announcements when the flow of primary equity capital is higher [Choe, Masulis, and Nanda (1993) and Bayless and Chaplinsky (1996)].

lower costs in hotter markets due to investor ebullience or lower certification effort are small relative to marketing costs.[11] All other coefficient estimates remain significant with the previously discussed signs. The variance inflation factors (VIFs) for the independent variables in Model 5 indicate that multicollinearity is not large.

1.2 How large is the fixed cost?

The regression estimates shed light on the importance of fixed cost. The spectrum view suggests that much of the underwriter fee is variable cost. However, one rationale for the economies of scale view is that a large part of underwriter compensation is fixed cost.[12]

To obtain the fixed cost estimate implied by the regression, multiply the inverse proceeds coefficient by 10,000 (= \$1,000,000/100%). In the more inclusive specifications, the estimated fixed cost (10,000 $\times$ b_1) ranges from \$222,000 (Model 4) to \$222,500 (Model 5) on average. Given the approximate average total fee of \$3,417,260 (the mean spread of 5.38% times the mean proceeds of \$63,400,000 from Table 1), the estimated fixed cost will range from 6.4% to 6.5% of total underwriter compensation, or from 0.35% to 0.36% of the mean level of proceeds. This evidence is consistent with the spectrum view that much of underwriting costs are variable for the observed public offerings.[13]

1.3 Is the marginal spread rising?

Consider next the hypothesis that the marginal cost of underwriting is rising. Using Equation (3), the estimated marginal spread (ms_i) for issue i implied by Equation (11) is

$$ms_i = b_0 + 2\frac{b_2 x_{1i}}{x_{2i}} + b_3 x_{3i} + b_4 x_{4i}. \tag{12}$$

For the sample, the average marginal spread for an additional million dollars is \$51,488. From Equation (12), issuer i's estimated marginal spread slope is

$$ms_i' = 2\frac{b_2}{x_{2i}}. \tag{13}$$

Panel A of Table 3 reports the sample mean estimated marginal spread slope is \$299.33. Thus, at the means, if the firm were to seek an

[11] Variations of the primary activity variable were examined including activity in the issue month and the prior two months, and the number, of seasoned offerings (rather than dollar flow) corresponding to each of the four activity variables. All results obtained using these different measures are qualitatively similar so we do not report them.

[12] Blackwell and Kidwell (1988) use the fixed cost explanation for economies of scale in their analyses of private and public bond offerings.

[13] While the estimated fixed cost may at first seem intuitively low, consider the total cost of underwriting the smaller deals in Table 1 as an upper-bound estimate of fixed cost.

Table 3
Estimates slopes of the marginal spread and the percent of issues in the diseconomies of scale region of the spread (*t*-statistics reported in parentheses)

Panel A. Marginal spread slope estimates

	Equity offerings		Bond offerings	
Proceeds ($ millions)	Number of issues	Marginal spread slope	Number of issues	Marginal spread slope
$10 to $20	230	$728.15 (25.08)	163	$45.02 (10.73)
$20 to $30	228	393.34 (25.49)	152	23.31 (7.47)
$30 to $50	326	258.61 (28.48)	111	14.32 (7.95)
$50 to $80	267	136.74 (28.72)	92	8.81 (7.99)
$80 +	274	67.73 (17.63)	110	6.00 (7.68)
All	1,325	$299.33 (34.14)	628	$22.22 (16.07)

Panel B. Percent of issues in the diseconomies region of the spread[a]

Assumed overallotment used	Equity offerings Mean	Bond offerings Mean
No use	35.43%	29.94%
Full use	57.61%	n.a.

The equity (bond) offering sample is described in Table 1 (4). Panel A reports the mean marginal spreads based on issuer *i*'s marginal spread slope estimate $ms'_i = 2b_2/x_{2i}$. This is the slope of the first derivative of the estimated fee with respect to proceeds (i.e., the second derivative of fees with respect to the proceeds), where the fee is computed as the proceeds times the estimated spread, as measured using parameters from Model 5 of Table 2 (5). x_{2i} is firm *i*'s market value of equity at the time of the offering, equal to stock price times number of shares, as reported by CRSP. The slope estimates use parameters from Model 5 of Table 2 (5). Panel B reports the fraction of firms whose proceeds exceeds the proceeds level that minimizes the estimated spread as represented by the estimates using parameters from Model 5 of Table 2 (5), and is thus estimated by $x_{1i}^{\min} = \sqrt{b_1 x_{2i}/b_2}$.

[a]The overallotment option entitles the underwriting syndicate to sell an additional 15% of the number of shares, and is used only in the equity offerings. Calculations for percent of issues in the diseconomies region assume either that the overallotment option is not exercised or that it is exercised in full, in which case proceeds expand by 15%. There is no overallotment option for bond offerings.

additional $1 million in proceeds, the marginal cost would rise from $51,488 to $51,788. The table shows further that the estimated slope is positive and statistically significant in every size category. The results also indicate that the marginal spread is steeper for the smaller offerings. This is consistent with the spectrum of U-shaped spreads view.

1.4 Are the spreads U-shaped?

To shed light on the shape of the spread, Figure 3 reports the fitted spread from the Table 2, Model 5 estimates for three issuer classes. A smaller, riskier firm's spread is fitted at the sample 25th percentile value for firm size and 75th percentile for volatility. A spread for a larger, low-risk firm's issue uses the corresponding 75th and 25th percentile

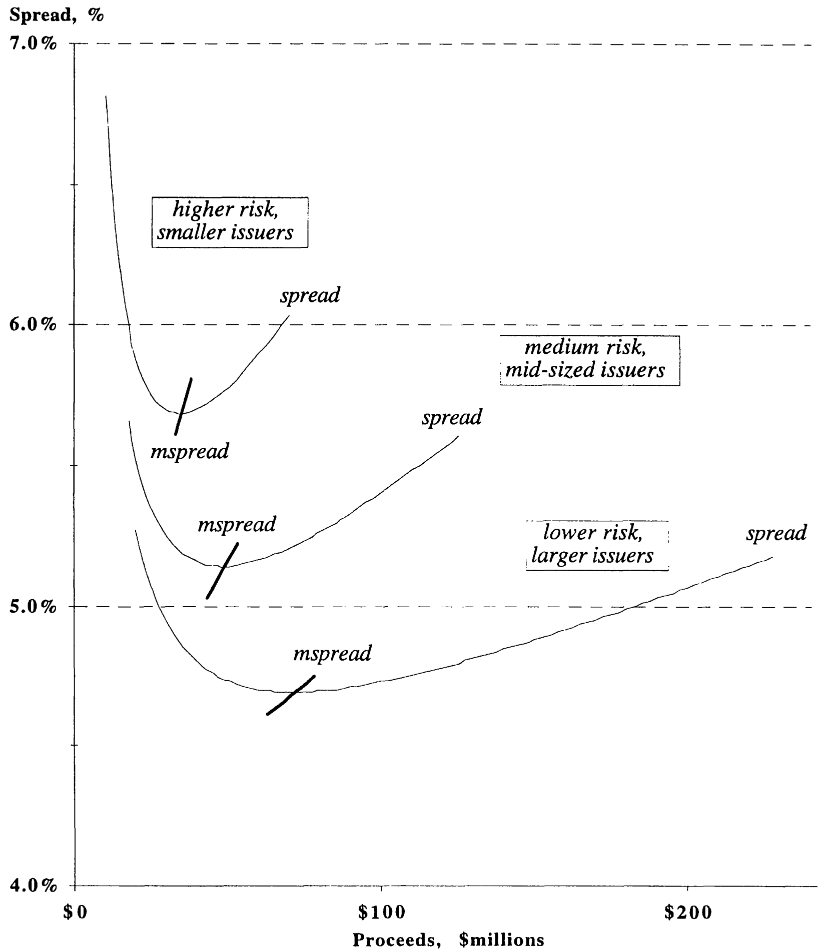

Figure 3
Predicted underwriter spreads for seasoned common stock offerings
The spreads are fitted using parameters from Model 4 in Table 2 over the indicated proceeds ranges. A smaller, riskier firm's spread is fitted at the sample 25th percentile values for firm size and the 75th percentile for volatility. A spread for the larger, low-risk firm's issue uses the corresponding 75th and 25th percentiles. A mid-size and medium risk firm's issue spread is based on sample median values for firm size and for volatility. The average and marginal spreads are denoted *spread* and *mspread*, respectively.

values. A mid-size and medium risk firm's issue spread is based on sample median values for firm size and for volatility. All three spreads are fitted using the sample mean value for primary equity activity.

Figure 3 shows that each issuer class faces a U-shaped spread. It reveals that there is a trade-off present in underwriting fees; fixed cost contributes to a falling spread as issue size expands, while variable cost is increasing. Moreover, small firms face a U-shaped spread that is northwest of mid-size firms' U-shaped spread, which is northwest of larger firms' U-shaped spread. This evidence is consistent with the spectrum of U-shaped spreads view.

1.5 Scale economies or diseconomies?

In the spectrum view, issues may be in either the scale economies or the diseconomies range of the spread, despite appearances in panel displays. One way to assess which range the issues are in is to compare the actual proceeds with the level of proceeds that minimizes the expected average spread, given firm size, volatility, and the activity of primary capital markets at the time of the issue. The estimated proceeds that minimizes the fitted value of Equation (11) for issue i is given by

$$x_{1i}^{\min} = \sqrt{\frac{b_1 x_{2i}}{b_2}} \,. \tag{14}$$

Using Equation (14), panel B of Table 3 reports that 35.43% of the equity issues are in the region of diseconomies of scale in the spread. If it is assumed that underwriters fully exercise the overallotment option that is present in almost all SEOs, raising an additional 15% in proceeds, then almost half (49.2%) of the equity issues are in the range of diseconomies of scale. Not reported is that 33% of the issues that are in the economies of scale region of the spread would be in the diseconomies region had their proceeds been 25% larger. These results are consistent with the conclusion that many firms issue equity in amounts that are in, or are very nearly in, the range of diseconomies of scale in the spread.

2. The Case of Straight Bonds

This section extends the investigation of the spectrum of spreads hypothesis to straight bond offerings. Bond spreads are very low relative to stock spreads, intuitively suggesting that their variable cost may be low and not rising. Consistent with this, several studies report evidence of economies of scale in bond offering spreads. However, the fact that many bond offerings are underwritten, and the previous discussion suggesting that underwriters provide meaningful services, predict that bond spreads will also be U-shaped.

2.1 The bond sample

Panel A of Table 4 reports spreads for 628 straight bond offerings obtained from SDC. The sample meets the same criteria used to

Table 4
Underwriter spreads, other characteristics, and S&P ratings of industrial bond offerings, 1990–1997

Panel A. Underwriter spreads

Proceeds ($ millions)	Number of issues	Mean spread (%)
$10 to $100	163	1.24%
$100 to $150	152	1.15
$150 to $200	111	1.05
$200 to $250	92	0.92
$250 +	110	0.61
All	628	1.09%

Panel B. Offer years and other characteristics

Year	Number of issues	Characteristic	Mean (median)
1990	41	Equity value	$4,124
1991	91		($2,301)
1992	90	Proceeds	$183
1993	98		($150)
1994	36	Volatility	1.97%
1995	83		(1.80%)
1996	81	Primary debt	$19,056
1997	59		($20,147)

Panel C. Standard & Poors bond rating

Rating	Number of issues	Rating	Number of issues
AAA	3	BBB	198
AA	46	BB	54
A	204	B, CCC	73

The sample was obtained from the Securities Data Company (SDC) and consists of industrial firms' offerings (those with SIC classifications other than 400s or 600s) during the January 1990 to December 1997 period. Offerings made within 30 days of each other and very small and very large issues (those under $10 million or over $1 billion in proceeds) are excluded. The issuer must be listed on CRSP for 260 business days before the offering and have accounting information on COMPUSTAT for the most recent fiscal year ending before the offering. The spread is total compensation paid to the syndicate from the offer prospectus, as a percentage of the proceeds. Equity value is number of shares outstanding times the price of common stock taken from CRSP as of one day before the offering. Standard and Poors bond ratings are from the SDC file. Stock return volatility is the issuer's stock rate of return standard deviation, estimated from daily returns during the 220 trading day period ending 40 days before the offering date. Primary debt is the aggregate value of all industrial underwritten debt financing during the three months leading up to the bond offering. All monetary variables are expressed in millions, and measured in January 1990 dollars using the Consumers Price Index as a deflator.

identify the equity offerings sample. Bond spread are of a significantly lower order of magnitude than stock offering spreads, averaging 1.09% for the sample. Note that the bonds spreads decline monotonically as proceeds expand, consistent with an economies of scale interpretation. Also evident is that bond offerings are typically much larger than stock offerings. The conventional wisdom is that smaller bond offerings, irrespective of the size of the issuer, will be privately placed. Similar size differences between stock issuers and bond issuers are documented in Mikkelson and Partch (1986), Hansen and Crutchley (1990), and Jung, Kim, and Stulz (1996), among others. Further, bond issuers have lower volatility than stock issuers. The average total value of the flow of industrial bond offerings during the three months leading up to the bond offering is $19.1 billion for the sample period.

Standard & Poors (S&P) bond issue ratings at the time of the offering, taken from the SDC, are reported in panel C. Almost 80% of the issues are rated either A or BBB. For convenience we have grouped the three CCC rated issues with the B rating group.

2.2 Bond spread model estimates

Table 5 reports the spread model estimates. The Model 1 estimates are for the simple economies of scale view and Model 2 includes volatility

Table 5
Ordinary least squares estimates of spreads paid in straight bond offerings
(t-statistics reported in parentheses)

	Model					
	1	2	3	4	5	VIF[b]
g_0	2.60	1.75				
	(9.95)	(11.67)				
g_1	−0.30	−0.19				
	(−5.86)	(−7.63)				
b_0			0.50	0.55	0.51	
			(12.12)	(11.89)	(8.79)	
b_1			25.17	22.76	22.64	1.05
			(5.95)	(9.82)	(9.76)	
b_2			4.63	1.57	1.55	1.55
			(19.71)	(9.40)	(9.31)	
$b_{\text{CCC-B}}$		1.58		1.36	1.35	26.00
		(25.35)		(21.94)	(21.60)	
b_{BB}		1.02		0.93	0.92	20.60
		(15.58)		(15.40)	(15.17)	
b_{BBB}		0.22		0.24	0.24	47.19
		(2.12)		(2.47)	(2.52)	
b_{A}		−0.07		−0.04	−0.04	48.18
		(−1.36)		(−0.75)	(−0.75)	
b_3		0.30[a]			0.26[a]	1.08
		(1.54)			(1.20)	
Number of issues	628	628	628	628	628	
Adj. R^2	0.05	0.77	0.43	0.81	0.82	
F	34	355	229	446	359	

The sample is described in Table 1. Model 1 is $s = \gamma_0 + \gamma_1 \ln(x_1) + e$, where s is the percentage underwriter spread reported on the offering prospectus. x_1 is the gross proceeds from the cover of the prospectus in millions. e is the error. Estimates of Greek coefficients are denoted in lowercase Latin. Models 3 through 5 are variations of $s = \beta_0 + \beta_1 \frac{1}{x_1} + \beta_2 \frac{x_1}{x_2} + \beta_3 x_3 + \sum_{SP=B}^{AAA} \beta_{SP} x_{SP} + e$. x_2 is number of shares outstanding times share price as of the offering. x_3 is the value of all firm underwritten bond offerings by industrial firms over the prior three months, as reported on the SDC file. The x_{SP} are zero-one dummy variables for Standard and Poors bond ratings B to AA, with three AAA rated bonds included in the AA category, and three CCC rated bonds included in the B category. All monetary variables are measured in January 1990 dollars using the CPI as a deflator.

[a] The coefficient b_3 is multiplied by 100,000.

[b] VIF denotes the variance inflation factors for the Model 5 estimates. VIF equals $1/(1 - r^2)$, where r^2 is from the regression of the independent variable on the remaining independent variables.

as a first approximation for risk. The negative coefficient on the logarithm of proceeds is consistent with the economies of scale interpretation. Further, the spread increases with volatility. However, when the model is expanded to allow for a spectrum of spreads it is evident that the linear in logarithms model does not fit the data as well (an adjusted R^2 of 5% versus 43%). Model 3 estimates suggest that variable costs are important in bond spreads. The positive coefficient on relative offering size agrees with increasing variable costs as the proceeds expand. That coefficient is also consistent with the conclusion that bond issuers with greater market breadth, that is, a larger secondary bond market, will have a lower spread schedule for their bonds.

Model 4 incorporates the bond's S&P bond rating. The model includes four zero-one dummy variables for bond rating classes AA-AAA, A, BBB, and B-CCC, with the three AAA rated bonds combined with the AA rated bonds and the three CCC rated bonds combined with the B rated bonds. The inclusion of bond rating significantly improves the adjusted R^2, consistent with earlier studies that document the importance of bond ratings in pricing bond offerings.[14] A lower rating has a significant impact on bond spreads, consistent with the conclusion that lower quality bond issues face higher spread schedules. Similar results are obtained when the S&P bond rating is replaced with return volatility. However, using the bond rating dummy variables improve the adjusted R^2 significantly so those results are not reported.[15]

Model 5 is expanded to include primary bond capital activity compiled from the SDC bond data. The earlier discussion suggests that a more active bond market may be associated with lower spreads due to investor ebullience and reduced adverse selection. Alternately, a higher spread will result if the more active bond markets lead to more crowded selling. The estimated bond market activity coefficient is positive, consistent with the interpretation that busier bond markets are associated with more crowded selling. However, the significance level of the coefficients is below conventional levels for a two-tail test.[16] Note also that the VIFs for Model 5 do not indicate the presence of significant multicollinearity among the continuous variables.

[14] Studies reporting the importance of bond ratings for bond spreads include Ederington (1975a, b), Sorensen (1979), Blackwell and Kidwell (1988), Allen, Lamey, and Thompson (1990), Lee et al. (1996), and Jewell and Livingston (1998).

[15] The bond regression estimates also reveal a drop in the inverse proceeds coefficient when bond risk is explicitly accounted for. This is consistent with the inverse proceeds picking up bond risk when no measure of risk is included.

[16] We also find that bond spreads are higher during busier primary equity markets, as in the case for equity offerings. The Pearson correlation coefficient between equity activity and bond activity is 0.73, with a p-value of 0.00, which suggests that these two activity variables are sufficiently correlated and register similarly busy periods.

2.3 Fixed cost, marginal cost, and the spectrum of spreads

Point estimates suggest that bond syndicate fixed cost implied by the Table 5 models is $227,000 (Model 4 or 5). As a percentage of the approximate average total underwriting fee of $2,190,900 (1.09% times $201,000,000), the estimated fixed costs are 10.4% of the spread, or 0.11% of total proceeds. This suggests, as in the case of the equity issues, that fixed cost is not a large portion of underwriting cost.

Using the estimates from Model 5 of Table 5, the value of bond issuers' marginal spread, computed similar to Equation (12), at the sample means is $17,369 per million dollars in proceeds. Table 3 reports mean estimates of bond issuers' marginal spread slope, as implied in the estimates of Model 5 in Table 5. The mean estimates are statistically significant and show that bond issuers face a rising marginal spread, and more so for smaller issuers.

Figure 4 reports predicted spreads for three bond risk groups, AA-AAA, A, and BBB, using the parameter estimates from regression 4 of Table 5. The fitted spreads are at the 75th (BBB), 50th (A), and 25th (AA-AAA) percentiles of firm value (S&P rating). In each case the sample mean value for primary debt market activity is used. Figure 4 reveals that bond issuers encounter a spectrum of U-shaped spreads. Larger and less risky issues pay lower spreads, reflecting the tendency for larger firms to have higher quality issues. The figure suggests that smaller and riskier issues encounter steeper marginal spreads.

Table 3 reports that the fraction of bond issues that are in the range of diseconomies of scale, using Equation (14), is 29.94%. Moreover, 35.99% of the bond issues that are in the scale economies range would be in the diseconomies range if their proceeds were expanded by 25% (not reported in the table). These results are consistent with the conclusion that many firms issue bonds in the range of diseconomies of scale in the spread.

3. Conclusion

This article attempts to reconcile the popular wisdom that underwriter spreads fall as more capital is raised with underwriting theories which suggest that spreads should be rising for many issues. We investigate the hypothesis that the issuers face U-shaped underwriting spreads and rising marginal spreads beyond some level of new capital. Initially the spread declines as fixed cost is distributed over the proceeds. As more capital is raised beyond some amount the spread will increase because of diseconomies of scale in the supply of syndicate services. We conduct tests and find that issuers face U-shaped spreads, and that the U-shaped spread is lower for larger issues. We suggest that this is why panel data

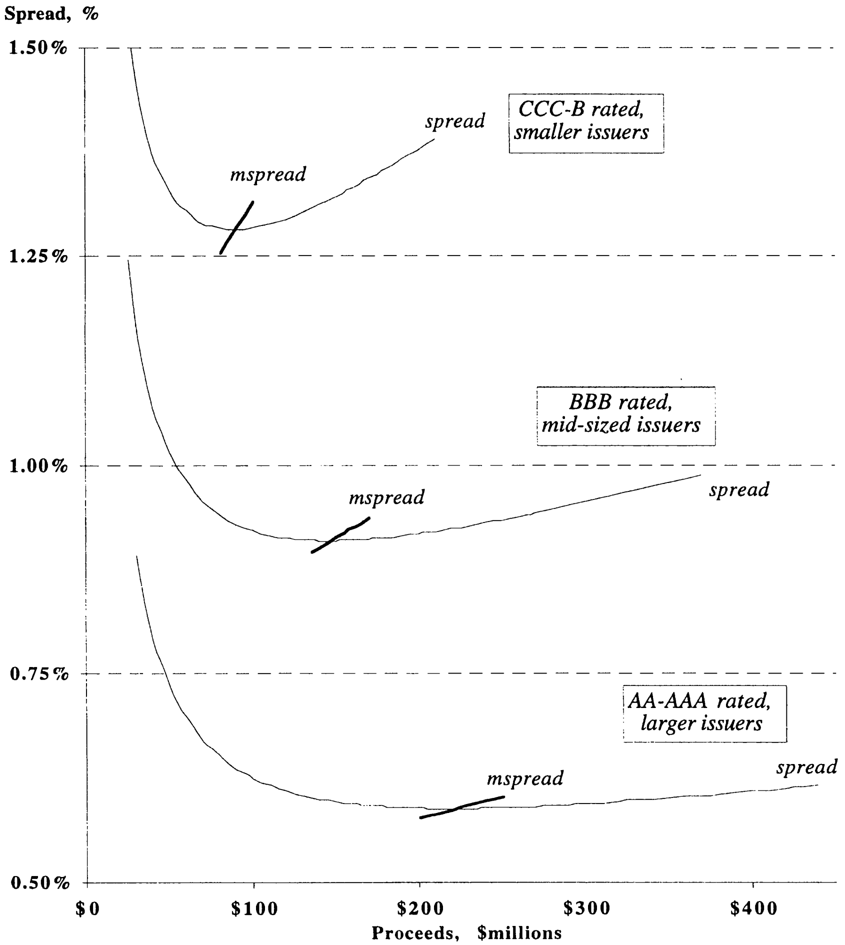

Figure 4
Predicted underwriter spreads for bond offerings
The spreads are then fitted using parameters from Model 4 in Table 5 over the indicated proceeds ranges. A smaller, riskier firm's spread is fitted at the sample 25th (CCC-B) percentile values for firm size and S&P bond rating. A spread for the larger, low-risk firm's issue uses the corresponding 75th (combined AA-AAA) percentiles. A mid-size and medium risk firm's issue spread is based on sample median values for firm size and S&P bond rating. The average and marginal spread are denoted *spread* and *mspread*, respectively.

project the image of declining costs, which seems contrary to underwriting theories.

We believe that our evidence may also help fill an important gap in the evidence of external financing cost. Financing theories predict that external cost is rising because of adverse selection cost [Myers and

Majluf (1984), Krasker (1986)] and overinvestment cost [Jensen (1986), Stulz (1990)]. Others assume a rising external marginal cost or that a "wedge" between internal and external cost increases as more capital is raised [Froot, Scharfstein, and Stein (1993), Froot and Stein (1997), Kaplan and Zingales (1997), Stein (1997), Hubbard, Kashyap, and Whited (1995)]. To support the rising cost condition authors have relied on the evidence of negative price reactions to financing announcements [Hubbard (1998)]. Yet that evidence does not support a rising cost. First, it is unclear how much of the price impact is a financing cost. This is because security sales may often signal information that would be known later anyway. In this case the price reaction is not a cost, except perhaps for those investors who had planned to sell their shares earlier.[17] Second, the clear consensus from many studies is that the price reaction is independent of the amount of capital raised.[18] In contrast, we report clear evidence of rising external financing cost.[19]

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[17] For example, in Miller and Rock (1985), security issuance announcements cause price declines because they release unanticipated bad news about corporate earnings, in which case the price impact is not a cost of the financing. Studies documenting that long-term earnings turn down significantly after seasoned equity offerings include Hansen and Crutchley (1990) and Loughran and Ritter (1997).

[18] Tests rejecting the hypothesis that the price reaction to equity financing announcements is worse for larger offerings are reported by Dann and Mikkelson (1984), Mikkelson and Partch (1986), Barclay and Litzenberger (1988), Hansen and Crutchley (1990), Korajczyk, Lucas, and McDonald (1990), Denis (1991), and Jung, Kim, and Stulz (1996). Although Masulis and Korwar (1986) and Asquith and Mullins (1986) report a marginally significant relationship between the proceeds and the price impact, they report finding opposite effects of the proceeds on the price impact. Dann and Mikkelson (1984), Eckbo (1986), Mikkelson and Partch (1986), and Chaplinsky and Hansen (1993) report tests that reject a size effect in bond offerings.

[19] The spread is the largest out-of-pocket financing cost and is often the largest part of total external financing cost. Other costs include expenses for preparing the offering and underpricing. In SEOs these costs are well below the spread and usually below 2% of the proceeds. Another small cost stems from the overallotment option [Hansen (1986), Smith (1986), Hansen, Fuller, and Janjigian (1987)].

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