Advantageous Innovation and Imitation in the Underwriting Market of Corporate Securities*

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Abstract

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JEL Classification: G24, L12, L89.

Keywords: Financial innovation, sequential innovation, investment banking, underwriters' expertise, learning.

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Abstract

Investment banks that develop new corporate securities systematically lead the new underwriting market despite being imitated early by equally competitive rivals. We model the competition between innovators and imitators for underwriting mandates in order to identify empirically the source of this advantage. Using data of innovative securities since 1985, we find that innovators set higher fees than imitators. This difference decreases as more issues occur, and faster for later generation products. The entry of imitators is also quicker for later generations. We conclude that the first-mover advantage comes from a superior expertise structuring and underwriting issues of the new security.

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Investment banks have been at the forefront of financial innovation for more than two decades, increasing the variety of securities that firms can issue to raise new funds. The volume that banks underwrite using these products has also taken an increasing proportion of the overall underwriting market. But innovation is followed by imitation: large, reputed banks avoid the research and development stage and compete with the innovator for underwriting mandates of the new security. Yet, the empirical evidence strongly suggests that the innovators of new securities are somehow able to preserve a competitive advantage over imitators. Why this is the case is an open question. It is important and timely to study the source and the evolution of the innovator's advantage if we want to understand the incentives for banks to innovate, how these incentives affect the speed of innovation and, in turn, how the protection of innovation through patent laws may affect these incentives.[1]

This paper shows that the innovator's advantage over its imitators comes from a superior expertise structuring and underwriting issues of the security it has developed. We identify this effect *over and above* other measures of the competitiveness of underwriters and show that it is of the first order. The estimated advantage is inherent to the security's innovator and is robust even to the presence of tough imitators. Our identification strategy is novel: we compare the equilibrium underwriting fees of innovators and imitators along the life cycle of each innovation, and across innovations that occur sequentially. The comparison is derived from a stylized model of underwriter competition where the effects over time of the superior expertise hypothesis are clearly distinguished from those of other sources of bank heterogeneity. The model also has distinct testable implications about the timing of imitation across different generations.

We implement the empirical tests with a data set of some of the most significant innovations in the last 20 years. We analyze all new issues of equity-linked and corporate derivative securities found in Thomson's One Banker data base (formerly SDC). These products have become increasingly important not only as a fertile ground for innovation but also as a large source of funds. Between 1985 and 2002 firms raised over $200 billion, which represents almost 16% of all the cash raised with common stock in the same period by all the firms in the US economy.[2] This class of securities has two other key characteristics: a high complexity of the securities' structures and a high variation in the actual engineering choices made by underwriters across issues (Schroth, 2006). Underwriters given the mandate have to specify a large number of parameters for each given issuer and investors characteristics at the time of the issue. Therefore, the bank's structuring ability must be an important determinant of this market's equilibrium.

All the banks that compete for underwriting mandates are large, reputed Wall Street firms. All of them have had underwriting relationships in the past with most issuers of innovative securities and have the ability to place large issues. In fact, we verify that variables traditionally used to measure underwriter's competitiveness explain poorly the innovative securities' underwriting fee differentials. Hence, we draw our inference from two previously overlooked characteristics of each issue: the issue order within the security and the generation number of each security. Indeed, these securities can be classified into product groups (index-tied principal, zero-coupon convertibles, mandatory convertible preferreds, etc.). Moreover, innovations within groups occur in an observable sequence. Further, issues themselves happen sequentially. Univariate comparisons across generations already reveal that the innovator's market share leadership is smaller for late generations. We propose a model to look more precisely into these differences and their specific timing in order to identify the expertise advantage hypothesis.

We use a stylized model of the competition between innovators and imitators for underwriting mandates. Banks are differentiated by the loyalty of their client base, their absolute underwriting ability, and their ability specific to each innovation. The specific ability is private to the innovator but the imitator learns it as the new security is issued repeatedly. Thus, the imitator learns the product design immediately but acquires the structuring ability slowly. In an equilibrium where both banks maximize their probability of getting the next mandate, the underwriting fee directly reflects the innovation-specific ability *differential* between innovator and imitators on top of underwriting costs. If there is a specific ability to learn, then this difference, and thus the fees, will be monotonically decreasing in the issue number, *ceteris paribus*.

The speed of convergence of the innovator's and the imitator's specific abilities increases with the innovator's initial advantage, i.e., the additional ability he gains from the development of each new product. The model shows that the initial expertise can be measured through the comparison of the underwriting fees of the first issues across generations. The speed of convergence is measured from a comparison of the fee differential between innovators and imitators and the interaction between the issue number and the generation number. Therefore, the superior expertise hypothesis' implication of faster convergence speeds for smaller initial advantages is testable with the fees across generations for given issue numbers.

The evidence is strongly in favor of the superior expertise hypothesis. The underwriting fees equation derived from the model fits well the actual fees data. We find that the underwriting fees set by innovators are larger than the imitators' for given generation and issue numbers. The innovator's fee for the first issue of first generations is on average between 10% and 15% higher than the imitators'. The difference is decreasing in the issue number, at a speed that increases with the generation number. On average, it takes between 9 and 12 issues of a first generation security for the imitator to compete at equal strength with the innovator. It takes less than two issues for 10th generation securities. This result is consistent with the intuition that later generation products typically build on a previous designs and are therefore less innovative than the previous generation, i.e., a smaller innovator's initial advantage.

The superior expertise hypothesis also has testable implications about the speed of imitation. The model predicts the probability that the imitator gets its first underwriting mandate at any given issue as a decreasing function of the innovator's initial advantage. Hence, the observed timing of the entry is a summary statistic of this entry time distribution. In consistency with our pricing evidence, we estimate the hazard rate of imitation function and find that the expected imitation times are decreasing in the security's generation number.

The hypothesis that innovators have a superior expertise has not been developed by the previous literature. There is anecdotal evidence mostly from practitioners' testimonies that suggests that reverse-engineering results in imperfect substitutes and that the innovator remains the most proficient issuer (Toy, 2001).[3] Clinical studies of the investment banking industry document how engineering skills vary across banks and that the necessary skills to structure the issue of a new corporate security take time to acquire (Eccles and Crane, 1988). The lack of development of this hypothesis may have been caused by Tufano's (1989) failure to find systematic differences in the underwriting fees of innovators and imitators. Indeed, Tufano's findings are inconclusive as to the source of the innovator's market leadership and, as he concludes, the mechanisms that reward innovation still remain to be studied (Tufano, 2003). What makes our results conclusive is the fact that we condition the comparison of fees between innovator and imitators on the issue timing and the generation number of the security.

The first formal test that the superior expertise plays an important role in financial innovation is performed by Schroth (2006). He estimates a structural model for the demand of underwriting services of innovators and imitators. To identify the innovator's advantage, this study focuses on the best way to instrument for underwriting fees. Here we look directly into the determination of the fees and identify the underwriters' relative abilities from fees data using the model.

Bhattacharyya and Nanda (2000) theoretically analyze the role of the costs of switching banks in financial innovation. They show that innovators can make positive profits despite fast imitation because they have loyal clienteles. Client loyalty implies that the innovator's profits may not be eroded by imitation, but it also implies that the advantage belongs to the second mover rather than to the first: if a bank can underwrite a perfectly imitated product for its own loyal clientele then, all else being equal, imitation should be more profitable than innovation because it saves the development costs. Also, we see empirically that even large banks have small market shares for some innovative products and this generally happens when they are imitators. We incorporate client loyalty à la Bhattacharyya and Nanda (2000) to the model and the empirical tests. The effects of past-relationships based loyalty measures on underwriting fees, if any, are very small relative to the effects of superior expertise.

Authors have mostly focused on the *diffusion* of financial innovation and the value to its end users (see Frame and White, 2004). Notably, Persons and Warther (1997) propose an information-based theory of the adoption of financial innovations by financing firms where non-adopters update their beliefs about the true value of innovative securities from the number of adopters. Thus, innovations diffuse in waves. Molyneux and Shamroukh (1996) search for the determinants of the speed of adoption of junk bonds. While this strand of the literature does not attempt to understand the incentives to innovate, our paper focuses directly on the dynamics of competition between the agents of corporate finance innovation, i.e., investment banks, during the innovation's life. Riddiough (2001) links the intermediation side with the investors' side of innovation by finding evidence that the structuring of commercial mortgage-backed securities responds to changes in credit agencies' and investors' valuation. Here we also argue that product structuring changes along the life cycle of a new security, but we take a step further and study the evolution of the structuring skills of different banks, and how this difference shapes the incentives to innovate.

This paper contributes also to the empirical banking literature (see Altinkilic and Hansen, 2000, for a synthesis). We follow this literature to specify the marginal cost of underwriting component in the underwriting fee, but we augment the specification to include the markup due to imperfect competition. Indeed, the size of the markup is determined in equilibrium as a function of the ability differential between the innovator and the imitator for given issue and generation numbers.

The evidence in this paper contributes to the ongoing debate about the costs and benefits of the recent strengthening of patents for business methods, which include most financial innovations. The evidence here shows that the innovator's profits and market leadership are maintained after imitation occurs but gradually fall over the life cycle of the new products (as conjectured by Van Horne, 1985). We also see that, the larger the market, the more mandates the innovator is able to secure early, effectively delaying the entry of imitators. It seems therefore that there is more need for patent protection in small, late-generation securities markets. The evidence also shows that innovation adds little value to the innovator and to the issuer in these markets. It seems likely then that the increased litigation required to protect such innovations will be wasteful, and also possible that the innovating banks will not even use it. Providing an answer to these questions is next in this line of research.

This paper has the following structure. Section I summarizes the data set and draws some preliminary conclusions to motivate the model and shape the empirical design. Section II lays out the basic model and characterizes the testable implications of the underwriting market equilibrium. Sections

III and IV are pivotal as we empirically test the predictions of the superior expertise hypothesis. Section V discusses some extensions to the model and further evidence to support them. Section VI summarizes the results and concludes briefly. The Appendices contain further robustness checks of the model and all the proofs.

I Data description

We use the New Issues section of Thomson's One Banker data base (formerly SDC) to construct a comprehensive data set of the market for underwriting mandates of innovative corporate securities. We obtain a full characterization of all the issues of Equity-linked and Derivative corporate securities in SDC. A key feature of our data is the order in which issues occur. All our equilibrium predictions and empirical tests associate the endogenous issue characteristics (e.g., the underwriting fee, the underwriter choice) with characteristics of the underwriter and the issue (e.g., underwriter experience, security class). These relationships depend crucially on the order of each security within a sequence of related innovations and in the order of each issue within each security. This feature allows us to identify the predictions of the superior expertise hypothesis and to distinguish its effects over and above the client loyalty hypothesis.

A Equity-linked and corporate derivative innovations

All equity-linked and derivative securities started to be issued by corporations after 1985. There have been 665 issues until 2004 by 30 different lead underwriters involving 50 different securities. Each security has a distinct design feature that distinguishes it from already existing products. They appear in the debt (D), convertible debt (CD), preferred (P) and convertible preferred (CP) classes. These products have become increasingly important not only as a fertile ground for innovation but also as a large source of funds. Between 1985 and 2002 firms raised over \$200 billion, which represents almost 16% of all the cash raised with common stock in the same period by all the firms in the US economy. Table I shows that the average issue raises almost \$234 million (standard deviation, \$299 million), which is almost twice as large as the average issue using standard D, CD, P and CP in the same period (average \$130 million, standard deviation \$152 million).

Underwriting fees are on average large, i.e., 2.41% (standard deviation 1.16%), relative to the contemporaneous underwriting fees of standard products (average 1.14%, standard deviation 1.40%). Unlike the case of SEOs and IPOs, underwriting fees for equity-linked and corporate derivatives exhibit significant variation.

<INSERT TABLE I ABOUT HERE>

Panel B of Table I shows that 18 of the 50 securities have been imitated. Over 60% of all the issues recorded correspond to imitated securities. There is significant heterogeneity in the times to imitation, measured either as the number of issues or days before the entry of the first imitator. Despite being imitated early (after 2 median issues), innovators have on average the largest market share (0.57, standard deviation 0.23).

B Product classification

We put all the securities into groups following Schroth's (2006) classification.[4] Table II shows this classification. The securities are listed in the order in which they historically appear. The largest groups, in terms of the number of products, are the groups of convertible preferred equity and the group of tax-saving, income deferring securities. These groups also exhibit significant imitation activity. Innovations in standard debt products (RISRS) or zero-coupon convertible debt (LYONS) brought about relatively large and long lasting underwriting markets but do not seem to have provided a fertile ground for subsequent development.

<INSERT TABLE II ABOUT HERE>

There are 98 bank-security pairs, as not all the participating banks compete in all 50 underwriting markets. It is clear from the list of participating banks that innovation and imitation in corporate products of the equity-linked or derivative type is a game between Wall Street's top banks. Most of them have vast underwriting experience, large placement capabilities and good relationships with institutional investors and frequent issuers.

These characteristics are generally used in the investment banking literature to capture the heterogeneity across banks competing for underwriting mandates of SEOs and IPOs. Given that this data is concentrated on the top banks, we expect these characteristics to vary little across banks. Other sources of heterogeneity across banks and securities matter more in this data set. The discussion that follows focuses on the distinction between innovators and imitators, and the heterogeneity in the generation number, i.e., the order of historical appearance, of each security. Table II shows significant variation in the generation number of imitated securities.

C Innovation and superior expertise

An innovation is a new corporate security that a firm can issue to raise funds. If the first issue of such security reveals the design of the product to other underwriters, then how could the innovator keep an advantage over them whilst competing against them for the next underwriting mandates? With equity-linked and corporate derivatives, as with many other corporate finance innovations, the underwriter must choose several contractual parameters that vary across issues. As an illustration, consider the following examples.

1. Examples

Preferred Equity Redemption Cumulative Stock (PERCS): PERCS are 3-year mandatorily convertible preferred shares that pay a fixed dividend. The conversion rate is one but the conversion value is capped if the common shares appreciate too much. Thus, each issue of PERCS specifies, among other things, the cap to the common stock returns, $\overline{r}$. The contract must also specify the dividends payable and the offer price (see Figure 1).

<INSERT FIGURE 1 ABOUT HERE>

A PERCS imitator learns quickly the mandatory capped conversion features in the new design but may need time to learn how to optimally set the contract parameters (caps, conversion rates, offer price) for each potential issuer. Hence, a potential PERCS issuer may value more the structuring skills of the innovator.

Index-tied appreciation notes: Generic index-tied debt (ELKS, MITTS) will specify the stock, or index of stocks, whose price is tied to the adjustable face value of the bond. The underwriter has to choose the underlying and the sensitivity of the face value to the underlying for each issue.

Issue customizing has been well documented and it is depicted in the testimonies of bankers collected by Eccles and Crane (1988). In addition, Schroth (2006) analyzes the structuring of equity-linked issues and finds a significant variation across the parameters within the same designs. In fact, Schroth (2006) finds much less variation within the imitators' set of issues. Hence, it seems that an imitator learns the product design and competes with the innovator early but lags in structuring skills.

More generally, the inherent characteristic of corporate innovations that we highlight in this paper is that the product design does not immediately disclose all the product information known to the innovator. The innovator provides a superior quality underwriting service by effectively having superior skills to deal with the following factors: (i) the choice of the issue's parameters (e.g., floors, caps) within the security design; (ii) the changes in the tastes of investors or market conditions that affect the issue proceeds; (iii) the provision of advice to issuers about the hedging of their liabilities;[5] and (iv) the resolution of legal or tax issues before the product can be issued[6] .

Other prominent financial vehicles not included in our sample share these features. For example, Goldman, Sachs and Co. pioneered and remained the lead underwriter of putable securities indexed to the Nikkei Index. The idea of issuing Nikkei Put warrants was disclosed rapidly to competitors but Goldman also hedged the issuer's exposure to the Nikkei privately, profiting from private information acquired during the development of the hybrid security.

2. Securities generations and value creation

Table II shows that there are sequences of innovations within a product group. Being in the same group, these products have common design features but later generations change or improve earlier designs. Consider the following example.

Dividend Enhanced Convertible Stock (DECS): DECS are also 3-year mandatorily convertible preferred shares, but they converts to one common share only if the stock appreciates more that $\bar{r}\%$ or if it depreciates. Otherwise, they convert to their fixed current common value (Figure 2). DECS are a third generation product derived from PERCS.[7]

<INSERT FIGURE 2 ABOUT HERE>

The generational aspect of corporate product innovation is crucial to the identification of the source of the first-mover advantage. If the imitator needs to acquire specific skills to match the innovator, it is likely that part of the skills learnt from underwriting early generations will still be useful to underwrite late generation products. In other words, it is likely that the skill differential between the innovator and its imitators will be smaller and shorter lived for later generations.

The generational aspect of corporate product innovation is also useful to understand the dynamics of value creation. Whether generations add value to the issuer at an increasing or decreasing rate is an empirical issue that we address with our model and empirical exercise. Some preliminary evidence is illustrative at this stage.

3. Comparing generations

Table III compares the main characteristics of issues of first generations and later generations. Three observations stand out. For first generations, (i) issuers pay significantly lower underwriting fees; (ii) entry is significantly slower, measured as the number of issues to imitation; and (iii) the innovator has a significantly larger market share.

<INSERT TABLE III ABOUT HERE>

The facts that innovators of later generations have smaller market shares than first generation innovators and that entry speeds up for later generations suggest that the innovator's advantage decreases with generations. This observation is consistent with our intuition that first-mover advantages due to skill differentials should diminish with generations. Is the fact that issuers pay more to underwriters inconsistent with that intuition? Not necessarily.

Later generations may improve earlier designs and increase the choice of the issuer as to what to issue. Issuers may pay more because they value later generations more than earlier ones. The model we propose interprets this data and allows us to identify the role of these effects by conditioning the equilibrium underwriting fees and market shares on the issue and generation number of each security.

D Client loyalty

The loyalty of clients is a prominent feature of the investment banking literature. Bhattacharyya and Nanda (2000) argue corporate finance innovation is profitable because issuers are reluctant to break their relationships with their underwriter. The underwriter exploits this loyalty by increasing the underwriting fee above the competitive price without losing the underwriting mandate. We measure the relative client loyalty at each issue t of security g by the propensity that the issuer, x, has had in the past to choose bank b over its rivals b' to underwrite g. The index is:

$$LOYAL_{t,g,b,x} = \frac{\#(\text{issues between } x \text{ and } b)}{\sum\limits_{\forall b' \text{in market } g} \#(\text{issues between } x \text{ and } b')} - \frac{1}{\#(b' \text{ in market } g)}, \tag{1}$$

where $\#(\text{issues between } x \text{ and } b)$ is the total number of past issues of any security since 1985 with the same issuer-underwriter pair; $\sum\limits_{\forall b' \text{in market } g} \#(\text{issues between } x \text{ and } b')$ is the sum of these counts for the same issuer over all banks that compete for security g and $\#(b' \text{ in market } g)$ is the number of such banks.

The first term of this coefficient measures how much more likely the issuing firm was to choose this bank in the past over all the other underwriters of this security. The second term normalizes for the fact that the number of competing underwriters is heterogeneous across securities. A value of zero means that the issuer has chosen all of the competing banks with equal likelihood in the past. We also refine this measure by counting only past issues of securities of the same class, i.e., D, CD, P, or CP, instead of all issues.

<INSERT TABLE IV ABOUT HERE>

We see in Table IV that, regardless of its definition, the loyalty index exhibits very little variation: the inter-quartile range for both measures is zero. Moreover, the univariate test shows no significant difference between the average of either measure of loyalty to innovators or imitators (p-values of 0.46 and 0.13). Further, loyalty covaries little with whether the underwriter is the innovator or not (correlation of 0.05 and 0.09). Thus, it seems that loyalty will have a small impact on the dynamics of market shares and equilibrium underwriting fees when tested formally.

E Summary

From this preliminary description, we conclude that an accurate interpretation of this data requires a model of the choice for an underwriter, where the services of competing banks (innovator and imitators) are differentiated. As shown here and previously, there is significant variation in the characteristics of underwriters and the issue itself (Riddiough, 2001 and Schroth, 2006).

To identify the role of differentiated skills and client loyalty, we need to condition the issue outcomes on the *timing* of it, i.e., the issue's number and the security's generation number. We continue by presenting the model, which incorporates the innovator's skill differential and the issuer's loyalty to each competing underwriter. The model predicts each underwriter's mandate probabilities and the underwriting fees on a issue-by-issue basis for different generations of securities. Thus, the model can fully exploit the data by testing the comparative statics predictions about the equilibrium fees, market shares, and the entry times of imitators over the life cycle of a security.

II The model

A The underwriting market

In period $t = 0$, an underwriter chooses whether to pay or not a fixed R&D cost to develop a new corporate security. If it does, it underwrites the first issue, revealing immediately the new design to its imitator. The imitator can free-ride completely the R&D cost, so $F_1 = 0$.[8] Let $b = 0$ denote the innovator and $b = 1$ the imitator (the case with more than one imitator is developed in the Appendix and produces the same qualitative results).

From period $t = 1$ onwards, one financing firm is drawn each period. This firm seeks to raise new funds and cannot delay the issue. Both underwriters bid for the mandate to structure and sell the security and compete in fees, p_b (i.e., the underwriting spread), to get the mandate.[9]

The innovation has a finite life of random duration. The probability that this security design is not replaced by a new one in the next period is $(1-\delta)$. For parsimony, we abstract from time discounting. Indeed, the timing of this game reflects issues intervals rather than chronological intervals.[10] Thus, the model's predictions can be tested at each observed issue in order of occurrence.

B The underwriting service

The underwriting service provided by banks is differentiated both vertically and horizontally. The vertical dimension measures the quality of the product and the underwriting service, $q_b(t)$: all other things being equal, an issuing firm prefers an underwriter who knows how to customize better the issue. Thus, whenever the innovator has a superior expertise, then $q_0 > q_1$. Let the quality differential $\Delta q \equiv q_0 - q_1$.

The horizontal dimension represents the preferences of issuing firms for a particular bank. Issuers are "located" on a unit interval and their unit mass is uniformly distributed over it (we relax this assumption in the Section V). The two competing investment banks are located at the extremes, as in Figure 3.

<INSERT FIGURE 3 ABOUT HERE>

A firm $x \in [0, 1]$ is partial to one bank. The distance to either represents the degree of loyalty to both. This setup captures the clientele stickiness of Bhattacharya and Nanda (2000) with a little more generality: the cost of switching banks is not the same for all firms, so loyalty varies smoothly from complete to none.

The preferences of a firm at x for either bank are given by

$$\begin{aligned} v_0(x) &= q_0 - p_0 - sx, \\ v_1(x) &= q_1 - p_1 - s(1-x), \end{aligned}$$

where s measures the intensity (unit cost) of loyalty. With this setup each bank has its own clientele of financing firms. We take the cost of switching as given and rule out the possibility that loyalty increases *during* the life cycle of the product. Adding this possibility to the model does not allow us to better interpret the data because, in the data, no firm issues the same security more than once. We discuss the effects of increasing stickiness for future innovations as an extension in Section V.

The drawn firm chooses its underwriter, b, to maximize v_b and has a reservation value normalized to zero, i.e., she cannot delay the financing. Each bank's profits per issue are

$$\pi_b \equiv (p_b - c)\, D_b(x, p_0, p_1, x, q_0, q_1, s, t) \qquad \text{for } b = 0, 1; \tag{2}$$

where the underwriting demand system is

$$D_b = \begin{cases} 1 \text{ if } v_b(x) > v_{b'}(x), \\ 0 \text{ otherwise,} \end{cases} \quad \text{for } b = 0, 1;$$

and where c represents the marginal cost of underwriting an issue (e.g., SEC filing, advertising, legal fees) and t the issue number.

At period zero, the expected profits for the innovator are

$$\Pi_0^e = -F_0 + \pi_0^e(0) + E \sum_{t=1}^{\infty} (1-\delta)^t \pi_0(t)$$

where $\pi_0^e(0)$ denotes the innovator's expected profits as the sole underwriter.

C Underwriter's expertise

Consider the following reduced form approach that captures the evolution of Δq. Let K represent the complete knowledge about the optimal underwriting quality factors listed above, e.g., how to choose the issue's parameters, how to get fast regulatory approval, etc. The underwriter's structuring skills are summarized by its knowledge of K. We can allow K to have as many dimensions as quality factors, but we develop here the more parsimonious but qualitatively similar case where K is a scalar.

1. The innovator's knowledge

No underwriter has perfect knowledge about K. Let the underwriting service quality, q_b, be the *precision* of the underwriter's information about K, where K is normally distributed with variance $\frac{1}{\kappa}$. R&D provides the innovator with noisy private information about K through a signal $K + k_0$. If k_0 is normally distributed with $E(k_0) = 0$ and $Var(k_0) = \frac{1}{\kappa_0}$ then Bayesian updating gives the innovator a posterior precision about K of

$$q_0 = \kappa + \kappa_0.$$

2. The imitator's learning

With each issue, the imitator gets a noisy signal of the innovator's signal, i.e., $K + k_0 + k_1$. Thus, the imitator increases its knowledge of K with each issue. However, due to the additional noise, the leakage of information about K to the imitator is only partial even with the disclosure of the security's design following its first issue. This setup captures the fact that reverse-engineering by imitators is imperfect. If k_1 is normally distributed with $E(k_1) = 0$ and $Var(k_1) = \frac{1}{\kappa_1}$ then we can establish the following:

Lemma 1 *The imitator's precision after t issues is*

$$q_1(t) = \kappa + \kappa_0 \frac{\kappa_1}{\kappa_1 + \frac{\kappa_0}{t}},$$

and the quality differential between the innovator and the imitator is

$$\Delta q(t) = \kappa_0 \left(1 + \frac{\kappa_1}{\kappa_0} t\right)^{-1}. \tag{3}$$

The proof to this Lemma is in the Appendix. The quality difference decreases and converges to zero with the issue number.

3. Expertise and product generations

Let the maximum underwriting quality increase from generation $g - 1$ to g by $\Delta\kappa(g)$. Thus, the maximum underwriting quality for a security g is

$$\kappa + \kappa_0 + \sum_{g'=2}^{g} \Delta\kappa(g'),$$

and the quality differential between the innovator and the imitator by issue t of generation g is

$$\Delta q(g,t) = \Delta\kappa\left(g\right)\left(1+\frac{\kappa_1}{\Delta\kappa\left(g\right)}t\right)^{-1}.$$

We will characterize the equilibrium fees and mandate probabilities (demand) for any t, g, and $\Delta\kappa\left(g\right)$. Note however that it is natural to assume that $\Delta\kappa\left(g\right) \geq 0$, as issuers would rather choose to issue $g-1$ if security g destroys underwriting value. We will estimate the time series of $\Delta\kappa\left(g\right)$ in our empirical section. Note however, that typically sequences of related innovations exhibit a diminishing pattern of improvement from one to the next. In fact, whenever a subsequent product is not as innovative relative to the previous, then $\Delta\kappa\left(g-1\right) > \Delta\kappa\left(g\right)$ and

$$\Delta q(g-1,t) = \Delta\kappa\left(g-1\right)\left(1+\frac{\kappa_1}{\Delta\kappa\left(g-1\right)}t\right)^{-1} > \Delta q(g,t) = \Delta\kappa\left(g\right)\left(1+\frac{\kappa_1}{\Delta\kappa\left(g\right)}t\right)^{-1}.$$

Intuitively, the innovator's expertise advantage is smaller for less innovative generations for the same issue number.

D Underwriting market equilibrium

1. Equilibrium mandate probabilities

Assume that $min(q_1, q_2) \geq c+s$ so that even the low quality bank would profit from any issue as a monopolist for any generation. After the first issue the innovator loses part of its market power as underwriters compete for the next firm that wants to issue the same new security. Let $\hat{x}$ be the issuer that is indifferent between both banks that set a fee at marginal cost. That is, $\hat{x}$ solves

$$\begin{aligned} q_0\left(g,t\right)-c-s\hat{x} &= q_1\left(g,t\right)-c-s(1-\hat{x}), \\ &\Rightarrow \hat{x} = \frac{1}{2}+\frac{\Delta q\left(g,t\right)}{2s}. \end{aligned}$$

Whenever the innovator's expertise advantage is high relative to the intensity of loyalty of its clients, i.e., $\Delta q\left(g,t\right) > s$, then $\hat{x} > 1$ so that even the most loyal client to the imitator chooses the innovator in equilibrium. The innovator, however, cannot set a fee as high as a monopolist.

Let $\overline{x} \equiv \min(1, \hat{x})$. In equilibrium, the innovator chooses a fee that guarantees him the mandate for any issuer $x \in [0, \overline{x})$. Similarly, the imitator gets mandates of issuers that are relatively loyal, i.e., that satisfy $x \in (\overline{x}, 1]$. The probability that an innovator gets the mandate is therefore $Pr(x \leq \overline{x})$, and Figure 4 illustrates both bank's mandate probabilities as a function of Δq.

<INSERT FIGURE 4 ABOUT HERE>

2. Equilibrium underwriting fees

For any $x \in [0, \overline{x})$, the innovator's equilibrium fee is obtained from the indifference condition

$$\begin{aligned} q_0(g,t) - p_0^* - sx &= q_1(g,t) - c - s(1-x), \\ &\Rightarrow p_0^*(g,t,s,x,c) = c + (1-2x)s + \Delta q(g,t). \end{aligned} \quad (4)$$

For any $x \in (\overline{x}, 1]$, the imitator's underwriting fee is

$$p_1^*(g,t,s,x,c) = c + (2x-1)s - \Delta q(g,t). \quad (5)$$

E Equilibrium comparative statics

The main sources of testable comparative statics in this model are s and Δq. All proofs to the propositions that follow are in the appendix.

1. Imitators entry time

As $\Delta q(g,t)$ decreases with t for a given g, the probability that the imitator gets the next mandate is zero until $\Delta q(g,t)$ becomes smaller than s. For any issue that follows, entry is a possible probability event and increasingly likely. The probability distribution of entry is characterized by the next proposition.

Proposition 1 *The probability distribution of the time of entry by the imitator at the N-th issue of security g is first order stochastically dominated by the distribution of the time of entry of security g' if and only if $\Delta\kappa(g) < \Delta\kappa(g')$.*

This result implies that the expected time of entry by an imitator is shorter the smaller $\Delta\kappa(g)$. We will verify this prediction in the data by comparing the sample distribution of the times of entry of imitators for all generations within each group.

2. Underwriting fees

It is clear from (4) and (5) that the difference in the underwriting fee charged by the innovator and imitator follows the behavior of $\Delta q(g,t)$. Thus, *ceteris paribus*, the equilibrium fee of the innovator is larger than that of the imitator, but the difference converges to zero with the number of issues within a security, g.

Another testable implication is that the speed of convergence is increasing in the innovator's initial advantage, $\Delta\kappa(g)$. In fact, the term $\Delta\kappa(g)$ is identified by (4) and (5) through the comparison of innovators and imitators fees across g for a given t.

3. Market shares

The next proposition characterizes the expected equilibrium market shares for the innovator and the imitator after any arbitrary number of issues of a security g using the equilibrium prices and the mandate probabilities for every (g,t).

Proposition 2 *The innovator's market share leadership over the imitator decreases with the number of issues within a security,* ceteris paribus. *The speed of market share convergence in the underwriting market for security g is larger than that for security g' if and only if $\Delta\kappa(g) < \Delta\kappa(g')$.*

4. Profits from innovation

The incentives to innovate and imitate are characterized by the following proposition.

Proposition 3 *The innovator's total profits and the incentives to innovate increase with the innovator's initial expertise advantage $\Delta\kappa(g)$ and decrease with the imitating precision, κ_1. The imitator's total profits decrease with $\Delta\kappa(g)$ and increase with κ_1.*

F Discussion

The model above is a stylized representation of the underwriting market that captures the main determinants of the choice of an underwriter and the pricing of an issue: the cost of underwriting, the underwriter's experience and the issuer's loyalty to the underwriter. The new element is the interaction between the loyalty intensity and the evolution of the innovator's advantage. This interaction is testable and allows us to measure empirically the relative importance of role of each in the underwriting market for new securities.

The model identifies the predictions of the superior expertise hypothesis from those of the client loyalty hypothesis using the dynamics of the equilibrium variables within each security and across securities. After controlling for loyalty with the measure in (1), the observed dynamics of each security's underwriting market can be matched to those predicted by Δq. Namely, we can estimate the initial innovator's advantage $\Delta\kappa(g)$ as a function of the observed generation number from the comparison of equilibrium underwriting fees across generations given the issue number. Also, the speeds of entry and fee convergence depend on the estimated $\Delta\kappa(g)$ and can be identified from the comparison of fees across issues within the same underwriter and generation. As we argued before, we expect $\Delta\kappa(g)$ to decrease with g, as later generations typically improve the previous ones at slower rates. Thus, we would expect faster entry and fee and market share convergence for later generations.

The effects of client loyalty on equilibrium underwriting fees and market shares follow directly from (4), (5), and the definition of the least loyal client, $\hat{x}$. The effects are qualitatively identical to those in Bhattacharyya and Nanda (2000): the innovator can charge higher fees, make larger profits and have a longer lived advantage over its imitators when all its clientele is more loyal (higher s) or when the clients seeking finance at the time are the most loyal ones (x close to zero). However, the loyalty hypothesis on its own, i.e., if $\Delta q(g,t) = 0$, would predict that imitation is immediate and that the expected market shares of the innovator and imitators are stationary.

The loyalty of the client base on its own may still provide profits to the innovator. However, if imitation is perfect then $\Delta q(g,t) = 0$ and the free-rider problem is most severe. Imitation would be more profitable than innovation and all banks would best-respond by waiting to imitate rather than moving first.

In this model, the innovator has an incentive to innovate in markets where imitators can extract less information from an issue, i.e., where κ_1 is low. This will be the case in highly volatile markets where changes in the economic environment may induce more variation in the structuring parameters across issues. Thus, innovation may occur more frequently in volatile markets not because issuing firms demand new securities that hedge increased risk but because in such markets banks would expect bigger and longer lived advantages as innovators.

Our analysis has also implications for the speed and timing at which product innovations are introduced into the market. While an innovator may have developed a new security, it may choose not to immediately underwrite an issue of that security because none of its clients may need finance at that time. Further, underwriting the issue for a firm that is not part of the bank's usual clientele will not be as profitable for the bank because of the switching costs the new client might bear. Hence, the innovator will choose not to trigger the imitator's learning process until it can make large profits from the first. The innovator will either wait or aggressively market the product to its loyal clients with the aim of securing a more profitable underwriting contract and the highest continuation profits.

III Evidence from the timing of imitation

Proposition 1 implies that market entry by imitators occurs sooner on average for later generation products than for earlier generations if later generations increase the value to the issuer with respect to previous ones at a decreasing rate. Table III showed that late generations are indeed imitated faster than the first ones. Figure 5 takes a closer look by plotting the empirical cumulative distribution function (CDF) of the speed at which a security is imitated.

<INSERT FIGURE 5 ABOUT HERE>

The dotted line is the CDF of the number of issues before imitation for all first generation imitated securities in our data. The solid line is the CDF of the number of issues before imitation for all imitated later generation products. As predicted, the imitation time CDF of later generations first-order stochastically dominates the imitation time CDF of first generations.

A The hazard rate of imitation

For a precise test, we estimate a model of the survival time, i.e., the issue count, before a security is imitated. We take every issue of every imitated security before imitation and pair the issue number of each with the relevant covariates. With this data we estimate the parameters of

$$\lambda_{g,t} = \exp\{-(\beta_0 + \beta_1 g + \beta_2 \mathbf{x}_{g,t} + \varepsilon)\}; \tag{6}$$

where $\lambda_{g,t}$ is the probability that security g is imitated immediately after issue t given that it has not yet been imitated. We use $\mathbf{x}_{gt}$ to capture characteristics of the market for security g that may speed up or slow down imitation. We use the total size of the market and the total number of issues ever. We also use the size of the first issue and the average size of all issues before t to approximate the imitator's expectations of the market size. We estimate β_0, β_1, and β_2 by maximum likelihood, using standard errors estimators that are robustly consistent to heteroskedasticity and correlation within securities in the same group.

We assume that ε is log-normally distributed so that $-\ln \lambda_g$ is the conditional mean of the distribution of the log of the imitation time for security g. The log-normal assumption implies that the baseline hazard rate is initially zero and increasing, implying that, *ceteris paribus*, it is initially very hard for a competitor to imitate a new security yet as time passes it becomes easier. We omit our results for other distributional assumptions, but they are available in a supplement to the paper. As expected, the results are virtually identical when we use distributions of the generalized F class. These distributions imply an increasing baseline hazard rate and thus all the estimates and the goodness of fit measures are basically the same as in the log-normal case.[11]

B Results

The first column in Panel A of Table V shows the benchmark estimates of the parameters in (6). As predicted, a higher generation index is associated, on average, with a larger hazard rate and thus, with a faster expected imitation time. The estimate is significantly different from zero at the 95% level. The joint hypotheses that all parameters are zero is also rejected. All the other columns show the results when we use different security-specific controls. The estimate of β_1 is steady, negative and significantly different from zero with at least 95% confidence in all cases.

<INSERT TABLE V ABOUT HERE>

Our estimates of β_1 are also economically significant. Panel A of Table VI shows the estimated median times of the entry of imitators, $\frac{1}{\lambda}$, for different product generations. We calculate these estimates at all the quartiles and at the mean of the sample distribution of the control variables using the estimates in column 5. The predicted median imitation time of a first generation security is almost four issues. The median imitation time is reduced by one issue on average for fifth generations and to 1.5 for 15th generations.

<INSERT TABLE VI ABOUT HERE>

The estimates of β_2 are positive and significantly different from zero to the 99% level when we use the total volume issued ever and the total number of issues ever (columns 2 and 3). Thus, imitation is slower on average for securities with bigger markets. As we argued before, the innovator has incentives to market aggressively the innovation to its close clientele, securing enough issues early before imitation effectively limits its market power. These incentives will be stronger for larger markets. The positive and significant estimates of β_2 seem to be capturing these effects.

Modelling the hazard rate of imitation with issue counts and approximating market size with ex-post measures will be more informative of the innovator's incentives to slow down imitation, conditional on g. To understand better the imitator's reaction, we use ex-ante measures, i.e., information about the market size available to the imitator as the market unfolds.

The coefficients of the size of the first issue and the average size of all issues before t are either small or insignificant (columns 4 and 5). In column 6 we augment the specification to include also the standard deviation of the issue size before t. The coefficient is positive and significant with 95% confidence. Hence, the imitator's uncertainty about the market size is what drives his entry time over and above the generation number. More uncertainty delays the imitator's entry.

C Calendar time to imitation

We redo the hazard rate analysis of the model in (6) using the calendar times (days) after innovation instead of the issue numbers. The imitator's efforts to enter the market would not be well captured by time measured with the issue number if some of the first few issuers had been already captive clients of the innovator. Panel B of Table V shows the parameter estimates and Panel B of Table VI shows their implied imitation speeds.

We confirm that the speed of imitation increases in g regardless of the speed measure (issues or days): the estimates of β_1 are positive and significantly different from 0 with 99% or 95% confidence in all six columns. The predictive roles of ex-ante and ex-post measures of market size have reversed. Ex-post measures have no effect on the hazard rate of imitation (columns 2 and 3) whereas ex-ante measures now have a negative and significant effect. Larger pre-imitation issues on average accelerate imitation in terms of days but not in terms of issue counts. Our initial interpretation is therefore supported. The larger the expected market size, the faster imitators will try to enter the market. They will achieve this goal in terms of calendar time but not in terms of the number of issues because the innovator will also move fast to secure initial mandates.

Figure 6 illustrates the survival probabilities (i.e., the probability that a security has not been imitated within a certain time) implied by the estimates above.

<INSERT FIGURE 6 ABOUT HERE>

D Summary

We have shown in this section that the main driver of imitation speeds is the security's generation number. This speed is increasing in g. This effect is robust to the measurement of the speed of imitation: the issue count or the number of days. On top of that effect, innovators slow down the entry of imitators by securing more underwriting mandates in larger markets. Imitators speed up their entry in markets they expect to be larger with less uncertainty.

IV Evidence from underwriting fees

The model's equilibrium fees by the innovator and imitator are respectively

$$\begin{aligned} p_0 &= c + (1-2x)s + \Delta q(t,g), \\ p_1 &= c + (2x-1)s - \Delta q(t,g). \end{aligned}$$

Therefore, the differences in the underwriting fees between these two bank, over and above bank-specific and issuer-specific characteristics, depend on the security's generation number, g, and the issue number within the security, t. The innovator's fee is higher than the imitator's but the difference decreases in the issue number. The difference decreases faster the later the generation number of the security if and only if the innovator's initial advantage decreases with g.

A The econometric specification

We model the underwriting fee of issue t of security g as

$$p_{t,g} = \gamma_0 + \gamma_1 INN_b + \gamma_2 INN_b \times t \times g + \sigma LOYAL_{t,g,b,x} + \boldsymbol{\delta}'_w \mathbf{w}_t + \boldsymbol{\delta}'_z \mathbf{z}_{b,t} + \upsilon_l + \eta_{t,g}. \tag{7}$$

where $\gamma_1 INN_b + \gamma_2 \times t \times g$ measures $\Delta q(t,g)$. INN_b takes value 1 if the underwriter of issue t is the security's innovator and -1 otherwise. The initial expertise advantage of the innovator for generation g is $2(\gamma_1 + \gamma_2 g)$. A first test of the superior expertise hypothesis is that $\gamma_1 + \gamma_2 g > 0$ for every g in the sample.

The initial expertise advantage, $\Delta\kappa(g)$, is decreasing with the generation number if and only if $\gamma_2 < 0$. If $\gamma_2 < 0$ then the advantage decreases at a rate of $-2\gamma_2 g$ per issue, i.e., faster for later generations. The implied issue number after which $\Delta q(t,g) = 0$ is given by $-\frac{\gamma_1}{\gamma_2 g}$.

$LOYAL_{t,g,b,x}$ is defined in equation (1). It measures the past likelihood of the issuer to choose underwriter b by the time of issue t of security g. Thus, it measures x. The parameter σ measures s and is interpreted as the importance of client loyalty for this segment of the underwriting market. For robustness, we reconstruct this measure counting: (i) only issues one year before t; and (ii) only issues of the same class, i.e., debt, convertible debt, preferred, or convertible preferred.

The vector $\mathbf{w}_t$ includes issue-specific controls to allow the underwriting fees to vary according to the marginal cost of underwriting an issue. We include the size of the issue (logarithm of the proceeds), and the security's maturity for issues of debt and convertible debt. We also include a dummy variable that takes value 1 if the issuer's debt is of investment grade. All specifications also include bank-specific characteristics through $\mathbf{z}_{b,t}$ to capture the fee variation due to differences in the reputation of the underwriter for placing an issue successfully. We use the bank's historical underwriting volume market shares for security g at t, and for all securities in the same class, $l = \{D, CD, P, CP\}$ as g.

We allow for further class-specific pricing differences trough υ_l. We estimate υ_l as a random or a fixed effect, and all the other parameters, $\boldsymbol{\gamma}$,σ, $\boldsymbol{\delta}_w$ and $\boldsymbol{\delta}_z$, accordingly. We include yearly specific dummies between 1986 and 2003 wherever noted. Finally, $\eta_{g,t}$ is the error term due to residual unobserved heterogeneity.

The specification above follows the empirical literature on underwriting fees (see Altinkilic and Hansen, 2000): it includes the issue size to capture economies of scale and issue and bank-specific measures to capture the increasing part of the marginal costs curve. It also includes bank-specific measures that capture the bank's generic underwriting service quality on top of the quality specific to the innovation. The new element in the specification above is that the comparisons of the underwriting fees are made across issues for a given security and across generations for given issue numbers. Tufano's (1989) failure to identify differences between innovator's and imitator's fees may have easily been caused by not making these two comparisons. Note too that the model attributes the fees levels to quality differences between innovators and imitators and not to the banks' security-specific underwriting quality levels. Therefore, the theoretical model has important implications for the identification of the determinants of the equilibrium fees in the sense that the effects of bank-specific characteristics in $\mathbf{z}_{b,t}$ account for pricing differences over and above the advantage intrinsic to the innovator.

B Results and interpretation

Table VII shows the estimates of the parameters of (7). Columns 1 through 3 estimate the model using all issues of all imitated securities in the data. Columns 4 through 6 exclude the first issue of each security (18 observations). If the fee for the first issue was effectively set before imitators had any knowledge of the new security structure, then it would have been set by a monopolist rather than by a leading oligopolist. We compute a random and a fixed effects estimator for all six specifications and report the former. Columns 2,3,5 and 6 include year dummies and based on the Hausman test we cannot reject that υ_l is uncorrelated with η_j. Thus, the inclusion of year dummies improves the specification and renders the random effects estimator consistent and efficient.

In consistency with our model, the estimates of γ_1 are positive for all specifications. The confidence level increases from 90% (columns 2 and 3) to at least 95% (columns 5 and 6) after excluding the first issues of all securities. Recall that the average underwriting fee for imitated securities is 2.33%. Hence, the implied average excess equilibrium fee of innovators with respect to imitators, that is, $\frac{\hat{\gamma}_1}{2.33}$, ranges between 8.9% and 16.5%. Columns 5 and 6 also show higher R^2s and lower Hausman statistics than 2 and 3. As we expected, the specification in (7) fits much better the sample that excludes the first issue. The estimate of γ_2 is always negative and different from zero with 99% confidence across all specifications. This result shows that each innovation adds less value on average than its predecessor. The innovator's expertise advantage decreases as more issues are completed and decreases faster for later generation products. Note too how stable these estimates are across all specifications with year dummies.

<INSERT TABLE VII ABOUT HERE>

We can never reject that σ is different from zero for all specifications in Table VII. We obtain this result regardless of how we measure loyalty, i.e., either using the counts of underwriter-issuer pairs for all securities or only for securities in the same class l as g. This result is driven by the fact that issuers of corporate derivatives are frequent issuers of securities in general and keep relationships with all the top banks. The typical issuer seems impartial to all competitors. This fact leaves little room for the loyal clientele hypothesis, and the variation in underwriting fees is effectively explained by the inter-generational and inter-issue comparisons.

The coefficient of the logarithm of proceeds is negative and seems to capture the economies of scale in an offering. It is significant with 90% confidence for columns 4 and 5, where the fit of the model in general is the best. The variation in maturity and investment grade don't seem to capture the fees variation as well as the bank-specific variables. The fact that the coefficient for the bank's volume share of corporate derivatives underwriting is negative suggests that it is capturing the bank's lower underwriting cost. Recall that levels of bank-specific variables in this model explain fees levels through the marginal costs of underwriting or the underwriting quality in general (*not* security-specific). Thus, the bank's success as an underwriter of any security, measured by the bank's volume share in the class, has a positive and significant coefficient and, therefore, captures the bank's underwriting quality level in general.

Table VIII interprets the estimates shown above and analyzes their economic significance. The number of issues before the innovator's expertise advantage disappears is $-\frac{\hat{\gamma}_1}{\hat{\gamma}_2 g}$. It takes at least 10 issues for the imitator to compete at equal strength with the innovator in the underwriting market for first generation products. For 15th generation products, the innovator faces the toughest competition immediately after it has innovated. Note that this is another consistency check of our model: the initial innovator's advantage, $\gamma_1 + \gamma_2 g > 0$ is positive for every generation number in our sample ($g \leq 15$). It is never the case that the imitator starts with a lead. This is strong evidence that our econometric specification effectively identifies advantages intrinsic to innovation and not to other bank characteristics (e.g., reputation).

<INSERT TABLE VIII ABOUT HERE>

C Robustness

1. Allowing for monopolistic fees

The pricing model fits better the sample of issues *after* the monopolist issue. Our interpretation was that monopolist issues are priced differently. In fact, the fee set by the innovator before the security design is disclosed to the imitator is $p_0 = q_0 - sx$. Hence, the monopolist fee is independent of the marginal cost of underwriting and the innovator's advantage over the imitator. It depends on the loyalty of the client and the *level* of the innovator's underwriting quality. Therefore, we use the full sample of issues to estimate

$$\begin{aligned} p_{t,g} &= \gamma_0 + \sigma LOYAL_{t,g,b,x} + \boldsymbol{\delta}'_z \mathbf{z}_{b,t} + \upsilon_l \\ &\quad + I_{\{t>1\}} \times [\gamma_1 INN_b + \gamma_2 INN_b \times t \times g + \boldsymbol{\delta}'_w \mathbf{w}_t] + \eta_{t,g}, \end{aligned}$$

where $I_{\{t>1\}} = 1$ for all issues after the first, and zero otherwise. Columns 1 through 3 of Table IX show the results.

<INSERT TABLE IX ABOUT HERE>

The R^2s are very similar to those where we excluded the 18 monopolist issues. However, we gain a lot of precision in the estimation of γ_1 and γ_2. In particular, γ_1 is now significant at least with 95% confidence. The estimates are close to the previous ones. Therefore, the generation number and the issue number have significant economic effects on the speed of convergence of the imitator's expertise with that of the innovator. The implied speeds of convergence are very similar to those reported in Table VIII and we do not report them here. They are available upon request.

Note that the underwriter's historical volume share in the class is not interacted with the oligopoly dummy $I_{\{t>1\}}$ and it still has a significant and positive effect on the underwriting fee. This confirms our earlier conclusion that it affects the fees through the bank's underwriting quality level. The bank's volume share of equity-linked and corporate products is multiplied with the oligopoly dummy and preserves the expected negative sign. It is likely that it is indeed capturing marginal cost heterogeneity across banks.

2. Post-imitation fees

So far we have estimated the model as if the imitator exerted a competitive pressure over the underwriting fee either since the first issue or since the second. It is impossible to know for sure since when exactly this pressure was effective. We do know that every issue since the imitators firt one occurs in an oligopoly and not a monopoly. Hence, we estimate the model restricting the sample to the 207 post-imitation issues.

As the selection of post-imitation issues may introduce a bias, we estimate the model

$$\begin{aligned} p_{t,g} &= \gamma_0 + \gamma_1 INN_b + \gamma_2 INN_b \times t \times g + \sigma LOYAL_{t,g,b,x} + \boldsymbol{\delta}'_w \mathbf{w}_t + \boldsymbol{\delta}'_z \mathbf{z}_{b,t} + \upsilon_l \\ &\quad + \delta_\lambda \lambda\left(t, \boldsymbol{\beta}'\mathbf{x}_g\right) + \tilde{\eta}_{t,g}, \end{aligned}$$

where $\lambda\left(t, \boldsymbol{\beta}'\mathbf{x}_g\right)$ is the inverse mills ratio derived from the hazard rate model of the time to imitation in (6).[12] Therefore, $\lambda\left(t, \boldsymbol{\beta}'\mathbf{x}_g\right) = -\frac{\phi\left(\frac{1}{\hat{\sigma}}\left(\ln t - \hat{\boldsymbol{\beta}}'\mathbf{x}_g\right)\right)}{\Phi\left(\frac{1}{\hat{\sigma}}\left(\ln t - \hat{\boldsymbol{\beta}}'\mathbf{x}_g\right)\right)}$ and $\hat{\boldsymbol{\beta}}$ and $\hat{\sigma}$ are the estimates shown in column 4 of Table V.

Columns 3 through 5 show the estimates with this correction. Qualitatively, the results are identical as those in Table VII. The R^2s have increased, and the loyalty measure has now a positive and significant coefficient to the 95% level (column 3). The estimates of γ_1 and γ_2 change little with this correction and our inference and conclusions remain unchanged.

D Summary

We have shown in this section that the observed underwriting fees fit very well the oligopoly model where innovators and imitators compete to get the next underwriting mandate. The comparison of the fees across issues within a generation and across generations for given issue numbers identifies the dynamic pattern of the innovator's quality advantage over its imitators: the innovator starts with an initial leadership that it uses to mark-up its issues while securing the mandate. This leadership decreases at a speed that is increasing in the generation number. The effects of this expertise advantage over the fees are of the first order, whereas the measures of client loyalty appear to have little or no predictive power.

V Further evidence and extensions

Below we present additional evidence found in our data and discuss some extensions to the model.

A Market share dominance

Our model predicts that the demand for the innovator's underwriting services and its equilibrium market share are overall larger than the imitator's but that this difference decreases with time. Tufano (1989) finds the innovators of corporate securities between 1971 and 1989 have the largest overall underwriting market share. Panel B of Table III shows the same result for innovators of all imitated equity-linked and corporate derivatives. It also shows that the innovator's leadership is bigger for first generation securities.[13]

The model predicts that the less value added by an innovation the smaller the demand and the market share advantage and the shorter the expected duration of this leadership. Our evidence from underwriting fees shows that the value added per innovation is decreasing in the innovation's generation number. Therefore, the evidence found by Schroth (2006) is a direct test of our model: he estimates the demand for the innovators' and imitators' varieties of equity-linked and derivative corporate products over time and confirms that, on average, the market demand for the innovator's product is greater than that for the imitator's in an arbitrary time period. This study also finds that the difference between the demand for the innovator's and the imitators' underwriting services converge faster for later generations.

B The length of product life

Later generations typically improve and replace previous ones. Thus, the actual life span of a security depends on the speed at which a later generation product is developed. To understand this relationship, consider this simple extension. After every issue of any given security, the innovator or the imitator may develop a new product in the group with probabilities δ_0 and δ_1, respectively. The probability that some bank innovates after t issues is

$$1 - (1 - \delta_0)(1 - \delta_1) \equiv \delta.$$

The expected number of issues before a given generation is replaced by the next equals $\frac{1}{\delta}$.[14] If the innovator uses his current expertise advantage also to develop next generations, then $\delta_0 > \delta_1$. The closer is δ_1 to δ_0, the higher is δ and the shorter is the life of the current generation. Thus, later generation products will be replaced faster by the next ones if $\delta_1 - \delta_0$ is decreasing in g. Panel B of Table III shows the observed number of issues per security. Later generations are shorter lived than the first.

C What products are imitated?

The shorter the life of a security, the lower the probability that it will be imitated. Later generation products are imitated faster conditional on being imitated. But due to their shorter life expectancy, we would expect less imitation later in a product sequence.

There are 18 of the 50 innovations in this sample that are imitated. Table X shows the distributions of imitated and non-imitated products conditional on whether these are first or later generation products. First generation products are significantly more likely to be imitated than later generation products: we can reject the null hypothesis of no association between the imitation and the generation number with 95% confidence. One explanation is that as later generation products are shorter lived, it is less likely that an imitator will underwrite an issue of such a product. This is even the case if it takes, on average, fewer issues by the innovator for the imitator to enter the market.

<INSERT TABLE X ABOUT HERE>

D Do innovators always persist?

We assumed that issuers were symmetrically distributed on the unit interval according to their loyalty to either competing underwriter. No bank had an advantage over the other before innovating. We now explore the dynamics of the innovator's expertise advantage when the innovator and the imitators have clienteles of different sizes. To model this simply, we assume that clients are distributed on the unit interval according to a beta density function

$$f_\alpha (x) = \alpha x^{\alpha-1} \qquad 0 \leq x \leq 1,$$

which is parametrized by $\alpha > 0$. For $\alpha < 1$ the initial client base advantage goes to the innovator and for $\alpha > 1$ it goes to the imitator. When $\alpha = 1$ we have the uniform case. Note that the indifferent client's location is still at $\overline{x} = \min\left(1, \frac{1}{2} + \frac{\Delta q}{2s}\right)$ but what changes is the mass of clients located on both sides of $\overline{x}$.

The expected one period profits of the innovator and the profit difference in all cases are

$$\begin{aligned}
\pi_0^e &= \int_0^{\overline{x}} \left[(1-2x)s + \Delta q\right] \alpha x^{\alpha-1} dx = \begin{cases} \Delta q + s\frac{1-\alpha}{1+\alpha} \text{ for } \Delta q > s, \\ \frac{2s}{1+\alpha}\left(\frac{1}{2} + \frac{\Delta q}{2s}\right)^{1+\alpha} \text{ for } \Delta q < s, \end{cases} \\
\pi_1^e &= \begin{cases} 0 \text{ for } \Delta q > s, \\ \frac{s}{1+\alpha}\left(2\left(\frac{1}{2} + \frac{\Delta q}{2s}\right)^{1+\alpha} - (1-\alpha)\right) - \Delta q \text{ for } \Delta q < s. \end{cases}
\end{aligned}$$

where $\pi_0^e - \pi_1^e = \Delta q + s\frac{1-\alpha}{1+\alpha}$.

Proposition 4 *The larger the initial clientele of a bank, the greater the profits from each issue regardless of whether the bank is the product innovator or imitator.*

We learn from this result that the initial client base can have an important effect on the incentives to innovate. *Ceteris paribus*, it may not be profitable for a bank with a smaller *initial* client base to develop a new product that will later be imitated, whereas it may be profitable for a bank with a larger initial client base to do so. As a result, banks with larger client bases should innovate more often.

The above argument brings us to the relation between innovation and reputation. It is often argued that in the financial sector there are returns for being a leader rather than a follower. Many firms prefer to be clients of a bank that innovates more frequently than of one that does not innovate or does not innovate frequently. This effect can be captured in our model if we assume that every product innovation makes α decrease. If the potential developer of a new product can expand its client base, i.e., gain additional clients for its more traditional services as a result of an enhanced reputation, then it has an additional incentive to develop new products as in the future higher profits can be expected from a larger client base. Morgan Stanley's dominance in convertible preferred stock in the early and mid nineties is a notable example consistent with this prediction.

Taking the argument further, if switching costs or client loyalty were the main source of profits for an innovator, then we would expect the same banks to innovate very frequently along the product sequence and others to be persistently "relegated" to the role of imitators. On the contrary, Table X shows that a significant share of the later generation products are innovated by banks that did not develop the first generation product. Of the 39 innovations that appear after the first generation product, 33 were innovated by banks that did not develop the first generation product. Moreover, we have seen empirically that bank-specific reputation measures do affect positively the bank's fees but that the effect of being innovator has a strong effect *over and above* reputation.

E Corporate derivatives and comanaged underwriting

We find one more explanation in the literature of why patents are not necessary for corporate finance innovation. Nanda and Yun (1995) argue that banks coordinate their R&D effort as a joint venture to overcome the free-riding problem. We believe, however, that this hypothesis does not apply to our data and the types of securities described in this paper. Firstly, our data set and that used by Nanda and Yun have only one security in common. Secondly, of the 665 underwriting contracts for equity-linked and derivative corporate securities only 13 were jointly underwritten by two or more lead underwriters. In fact, the underwriting role was only shared once in the first issue of a security.

VI Conclusion

The development process of new corporate products gives innovators superior expertise in structuring issues for potential issuing firms. The consequent market dominance of the innovator over its imitators is consistent with existing evidence in the literature (Tufano, 1989; Schroth, 2006). Our new evidence on the speed of entry of imitators into the market and the equilibrium underwriting fees for recent product innovations reveals important dynamics that match our predictions and rule out other explanations.

The expertise advantage of the innovator makes it more likely that it will recoup the R&D costs obtaining a positive profit from the innovation even without patent protection. The ruling in *State Street Bank vs. Signature Financial Group* in 1999, where the US Supreme Court upheld a patent for a financial business method, has caused a well-documented run on patents (Lerner, 2000). Whether patent and copyright protection is a good idea in general remains a controversial question among economists today.[15] Our results suggest that *State Street* may have unnecessarily increased the incentives for innovation at the cost of increased litigation and defensive patenting by investment banks. The net effect on the amount of innovation and its profitability for investment banks remain to be seen and studied.

Appendix 1: Proofs

Proof of Lemma 1. The covariance matrix for K and its signal, $K+k_0+k_1$, is

$$Var\begin{pmatrix} K \\ K+k_1 \end{pmatrix} = \begin{pmatrix} \kappa^{-1} & \kappa^{-1} \\ \kappa^{-1} & \kappa^{-1}+\kappa_0^{-1}+\kappa_1^{-1} \end{pmatrix}.$$

If all random variables are normally distributed then the posterior variance of the imitator's knowledge of K after t issues is

$$\frac{1}{q_1(t)} = \left(\kappa^{-1} - \kappa^{-1}\frac{1}{\kappa^{-1}+\kappa_0^{-1}+(t\kappa_1)^{-1}}\kappa^{-1}\right).$$

The imitator updates its estimate of K using the signals from each observed issue and Bayes Rule. The posterior precision of the imitator after t issues is then

$$q_1(t) = \kappa + \kappa_0\frac{\kappa_1}{\kappa_1+\frac{\kappa_0}{t}}.$$

The difference in quality between innovator and imitator is

$$\begin{aligned} \Delta q(t) &= q_0 - q_1(t) = \kappa + \kappa_0 - \kappa - \kappa_0\frac{\kappa_1}{\kappa_1+\frac{\kappa_0}{t}} \\ &= \kappa_0\frac{1}{1+\frac{\kappa_1}{\kappa_0}t}. \end{aligned}$$

■

Proof of Proposition 1. The probability distribution that the imitator gets its first underwriting mandate at the $N-$th issue is

$$\Pr(N) = 1 - \Pi_{t=1}^{N-1}\left(\overline{x}_t\right),$$

where $\overline{x}_t$ is the probability that the innovator gets the t-th issue, i.e.,

$$\begin{aligned} \overline{x}_t &= \min\left(1, \frac{1}{2} + \frac{\Delta q\left(g,t\right)}{2s}\right), \\ \text{for } \Delta q(g,t) &= \Delta\kappa\left(g\right)\frac{1}{1+\frac{\kappa_1}{\Delta\kappa(g)}t}. \end{aligned}$$

As $\Delta q(t,g)$ is increasing in $\Delta\kappa\left(g\right)$ for every t, then $\Pr(N)$ decreases in $\Delta\kappa\left(g\right)$ for every N. ■

Proof of Proposition 2 . The expected market share of the innovator after M issues (including $t = 0$) is

$$MS_0(M) = \left(1 + (N-1) + \sum_{t=N}^{M} \left(\frac{1}{2} + \frac{\Delta q(g,t)}{2s}\right)\right) / (M+1)$$

The expected market share of the imitator after $M + 1$ issues is

$$MS_1(M) = \left(\sum_{t=N}^{M} \left(\frac{1}{2} - \frac{\Delta q(g,t)}{2s}\right)\right) / (M+1),$$

The expected market share of the innovator is always larger than the expected market share of the imitator as long as $\Delta q(t) > 0$ but the difference is

$$MS_0(M) - MS_1(M) = \left(N + \frac{1}{s}\sum_{t=N}^{M} \Delta q(g,t)\right) / (M+1),$$

which is clearly decreasing in t because $\Delta q(g,t)$ is decreasing in t. Since $\Delta q(g,t) \leq s$ for $t \geq N$, then the innovator's market share is larger than the imitator's for any M. This happens for two reasons. First, the possible entry of the imitator is delayed. Second, even after entry, the probability that the imitator obtains the underwriting mandate is still smaller. Finally, it is clear that $MS_0(M) - MS_1(M)$ converges to zero. ■

Proof of Proposition 3. Let N be the first issue that the imitator can underwrite with positive probability. N solves

$$\begin{aligned}\Delta q(g, N-1) &> s > \Delta q(g,N), \\ &\Rightarrow N = 1 + \mathrm{Int}\left[\frac{\Delta q(g,0)}{\kappa_1}\left(\frac{\Delta q(g,0)}{s} - 1\right)\right].\end{aligned}$$

N is increasing in $\Delta q(g,0)$, decreasing in s, and decreasing in the information spillover precision, κ_1. The expected profits per issue are

$$\begin{aligned}\pi_0^e &= \int_0^{\overline{x}} (p_0^* - c)dx = \overline{x}\left((1-\overline{x})s + \Delta q(g,t)\right) = \begin{cases} \Delta q(g,t) \text{ for } \Delta q(g,t) > s, \\ s\left(\frac{1}{2} + \frac{\Delta q(g,t)}{2s}\right)^2 \text{ for } \Delta q(g,t) < s, \end{cases} \\ \pi_1^e &= \int_{\overline{x}}^1 (p_1^* - c)dx = (1-\overline{x})\left(\overline{x}s + \Delta q(g,t)\right) = \begin{cases} 0 \text{ for } \Delta q(g,t) > s, \\ \left(\frac{1}{2} - \frac{\Delta q(g,t)}{2s}\right)^2 \text{ for } \Delta q(g,t) < s. \end{cases}\end{aligned}$$

The total expected profits from innovation are

$$\Pi_0^e = -F_0 + \pi_M^e + \sum_{t=1}^{N-1} (1-\delta)^t \Delta q\,(g,t) + \sum_{t=N}^{\infty} (1-\delta)^t s \left(\frac{1}{2} + \frac{\Delta q\,(g,t)}{2s} \right)^2 ,$$

where $\pi_M^e = q_0 - \left(c + \frac{s}{2}\right) > \Delta q(g,0)$.

The total expected profits from imitation account for the expected profits from the period when the probability of obtaining the underwriting contract becomes positive,

$$\Pi_1^e = \sum_{t=N}^{\infty} (1-\delta)^t s \left(\frac{1}{2} - \frac{\Delta q\,(g,t)}{2s} \right)^2 .$$

The imitator's total profits decrease with its initial quality disadvantage $\Delta q(g,0)$ and increase with κ_1. ■

Proof of Proposition 4. Clearly, the innovator's profits per issue are decreasing in α, i.e., increasing in the initial client base. For the imitator

$$\frac{\partial \pi_1^e}{\partial \alpha} = \frac{2sB^{1+\alpha}\,(1 + \ln B) + 2\alpha}{(1+\alpha)^2} > 0$$

because $B = \left(\frac{1}{2} + \frac{\Delta q}{2s}\right) > \frac{1}{2}$. ■

Appendix 2: More imitators

Consider the case of one innovator ($b = 0$) and two imitators ($b = 1, 2$) that are located at the extremes of an equilateral triangle (Figure A2.1). The extension to more than two imitators is straight forward using higher-dimensional polygons.

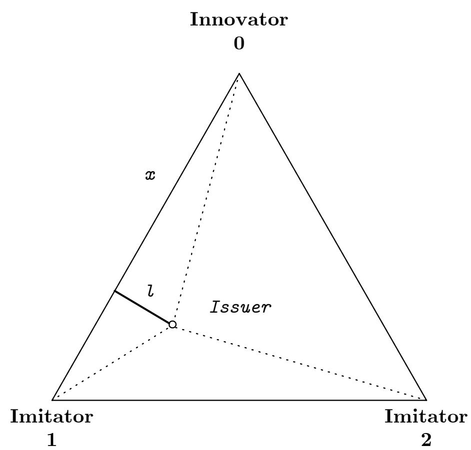

Figure A2. 1: Spatial representation of the issuer's preferences for three competing banks.

Since the two imitators have the same expertise, the imitator farthest from the issuer never obtains the underwriting mandate. Let $b = 1$ be, without loss of generality, the closest imitator. The values to the issuer located at $\mathbf{x} = (x, l)$ of choosing either underwriter are

$$\begin{aligned} v_0(x) &= q_0 - p_0 - sd(\mathbf{x}, 0), \\ v_1(x) &= q_1 - p_1 - sd(\mathbf{x}, 1), \end{aligned}$$

where d is the euclidean distance. Thus, $d(\mathbf{x}, 0) = \sqrt{x^2 + l^2}$ and $d(\mathbf{x}, 1) = \sqrt{(1-x)^2 + l^2}$. The location of the indifferent client, $\hat{x}$, equates $v_0\left(\hat{x}, \hat{l}\right)$ to $v_1\left(\hat{x}, \hat{l}\right)$ for $p_1 = p_2 = c$. Thus, $\left(\hat{x}, \hat{l}\right)$ is defined implicitly by

$$\sqrt{\hat{x}^2 + \hat{l}^2} - \sqrt{(1-\hat{x})^2 + \hat{l}^2} = \frac{\Delta q}{s}, \tag{8}$$

which is a hyperbola with vertex on $\left(x=\frac{1}{2}+\frac{\Delta q}{2s}, l=0\right)$ and with $\frac{\Delta q}{2s}<\frac{1}{2}$.The indifferent clients are those equidistant by$\frac{\Delta q}{s}$ to the two effective competitors, located at $(0,0)$ and $(1,0)$.

The value of $\hat{x}$ that preserves the equality (8) is increasing in Δq for any l.Hence, a higher expertise advantage of the innovator implies a larger clientele and a higher probability that the innovator will underwrite the next issue. Therefore, all the comparative statics of the two competitors model hold for any number of competitors because any bank's region of influence, i.e., its clientele, is increasing with its relative advantage (disadvantage), Δq $(-\Delta q)$.

Figure A2.2 below illustrates these comparative statics. Without any expertise advantage ($\Delta q=0$) we have $\hat{x}=\frac{1}{2}$ for $l=0$. The three banks have the same market share equal to $\frac{1}{3}$ (dotted lines). For a positive advantage, then $\hat{x}=\frac{\Delta q}{2s}+\frac{1}{2}>\frac{1}{2}$ for $l=0$ and the innovator has the largest market share (solid lines). If the innovator's expertise advantage is high enough, i.e. $\frac{\Delta q}{s}>1$, then the "indifferent" client curve lies outside the triangle, implying that the innovator surely underwrites the next issue surely.

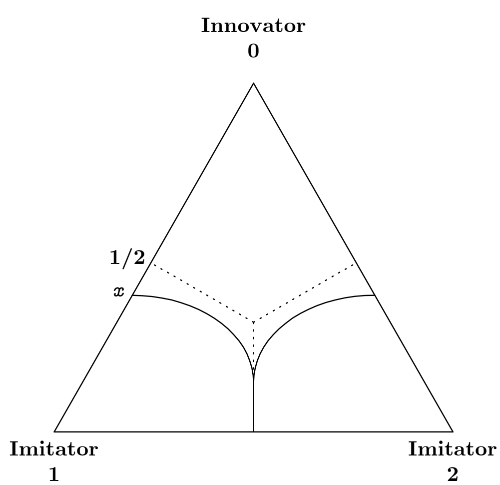

Figure A2. 2: Bank's clientels with and without the innovator's expertise advantage.

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Footnotes

1. Patents on corporate finance products belong to the "business methods or formulas" class and were therefore ruled invalid by the courts. The US Supreme Court upheld a patent on a "business method" in 1999 and it is believed that the *State Street Case* has set the precedent required to make patents for financial innovations more effective.

2. The total issued volume of equity-linked and derivative securities represents a very large share of the total volume underwritten by the participating banks. The average volume issued per underwriter of equity-linked and derivative securities between 1990 and 1999 was larger than the average issued volume of convertible preferred stock (e.g., 1.2 times larger between 1995 and 1999) and convertible debt (e.g., 1.1 times larger between 1995 and 1999), and about half of the issued volume of preferred stock. See Tufano (1995) and Finnerty (1992) for a general overview of innovation in corporate finance products. A more comprehensive survey of financial innovation is provided by Allen and Gale (1994).

3. The view that imitations are imperfect substitutes is summarized by the testimony of William Toy, a Managing Director at CDC Capital:

   > There is at least a perception that the first mover is more familiar with the product he issues than the imitator (personal interview, New York City, February 2001).

4. Innovative corporate products are classified by Schroth (2006) using a compilation of articles in the journals Investment Dealers' Digest, American Banker, Dow Jones Newswires and others found using the ABI Search Engine. These sources provide at least one description of every product and a reference to a similar older product. Tom Pratt column in the *Investment Dealer's Digest* describes almost every corporate security invented in the 80s and 90s.

5. We could relax this assumption to $F_0 > F_1 > 0$, but only to strengthen the innovator's expertise advantage without a change in the comparative statics.

6. Note that the price, p, is not the price at which the issue of the new security is sold to investors, but the fee that the issuing firm pays the underwriter to engineer and sell the security.

7. Time discounting can be easily incorporated to the model if we let $(1-\delta)$ be the product of the probability of continuation and the pure time discount.

8. In some cases the underwriter may buy some of the issued securities, in which case they need to understand the product's effect on the risk and returns of a portfolio. The case of the Nikkei Put Warrants introduced by Goldman, Sachs & Co. in 1990 illustrates these factors very well.

9. Goldman Sachs & Co, innovated and dominated the underwriting market for MIPS, mostly thanks to the research it conducted on Grand Cayman's corporate tax law. MIPS were vehicles to issue preferred stock through a Cayman-based subsidiary that would loan the entire proceeds to the already levered parent.

10. Subsequent generations of convertible preferred stock are ACES and PEPS. ACES convert one to one mandatorily after 4 years, floored and capped to the appreciation of common stock. PEPS convert mandatorily one to one after 4 years only if the common stock appreciates more than a threshold return.

11. The assumption of log-normality is more appealing theoretically and empirically over other alternatives. The implied baseline hazard rate of the other commonly used distributions, i.e., Exponential and Weibull, is time-invariant or decreases with time, respectively, implying counterintuitively that imitation becomes harder (or at least does not get easier) with time. Not surprisingly, the fit of our model under these assumptions was poor. The fit is good for all distributions of the generalized F class because they imply an increasing baseline hazard as in the log-normal case.

12. This equation is derived from the mean of the underwriting fee, conditional on the fact that the security has already been imitated. Thus, if N is the (random) imitation time, where $\ln N \sim N(\hat{\boldsymbol{\beta}}' \mathbf{x}_g, \hat{\sigma})$, then the

true model's residual is

$$
\begin{aligned}
E\left(\eta_{g,t}|\text{security } g \text{ is already imitated}\right) &= E\left(\eta_{g,t}|t \geq N\right) \\
&= E\left(\eta_{g,t}|z \leq \frac{\ln t - \hat{\boldsymbol{\beta}}'\mathbf{x}_g}{\hat{\sigma}}\right) \\
&= \delta_\lambda \lambda\left(t, \hat{\boldsymbol{\beta}}'\mathbf{x}_g, \hat{\sigma}\right) + \tilde{\eta}_{g,t},
\end{aligned}
$$

for $\lambda(.) = -\frac{\phi(.)}{\Phi(.)}$.

13. The measure of market share used here, by Tufano (1989) and by Schroth (2006) is the number of issues that a given bank has underwritten for product or within a product group divided by the respective total number of underwriting contracts. It is not the share of the underwritten *principal*. Implicit in this is the assumption that the amount of funds required by an issuing firm is known at the time the issuing firm has to choose an underwriter.

14. We can also let δ_0 and δ_1 increase with every issue. This would speed up the introduction of later generations even more.

15. The most prominent recent cases against patent or copyright protection are made by Jaffee and Lerner (2004) and by Boldrin and Levine (2006).

Figure Captions

Figure 1: The conversion rate of a Preferred Equity Redeemable Stock (PERCS), as a function of the returns of the underlying common stock. Each unit of this preferred stock converts mandatorily after 3 years to one unit of common stock unless the common stock appreciates above a cap of $\overline{r}$ percent. If after 3 years the common stock appreciates above the cap, PERCS convert to less than one unit of common stock such that their conversion value is that of a stock that has appreciated by $\overline{r}$ percent.

Figure 2: The conversion rate of a Dividend Enhanced Convertible Stock (DECS), as a function of the returns of the underlying common stock. Each unit of this preferred stock converts mandatorily after 3 years to one unit of common stock unless the common stock appreciates within 0 and $\overline{r}$ percent. If the common stock appreciates within these boundaries in 3 years, then DECS convert to less than one unit of common stock such that their conversion value is that of the stock's price at the issue date.

Figure 3: Spatial representation of the issuer's preferences for competing banks. This figure illustrates the horizontal dimension of differentiation in our model of the corporate underwriting market. Issuers lie along a unit interval according to their degree of loyalty to either bank. The two banks are located at the each extreme, and the closer an issuer of type x is to a given bank, the more loyal it is to the bank, i.e., the more expensive it is for the issuer to hire another bank as its underwriter.

Figure 4: Probabilities that the underwriter of the next issue is the product innovator (black line) or its imitator (gray line) as a function of the quality differential (Δq). This figure illustrates the choice of an underwriter by the issuer of a new security. The black line plots the probability that the issuer chooses the innovator, as a function of the difference between the quality of the underwriting service provided by the innovator or the imitator. The gray line plots the probability that the issuer chooses the imitator. The larger the Δq, the higher the probability that the innovator gets the next contract. For a large enough Δq, then any issuer will prefer the innovator and the probability that the innovator gets the mandate 1.

Figure 5: Empirical cumulative distribution function (CDF) of the speed at which a security is imitated. This figure illustrates the speed at which a security is imitated conditional on its generation index. The speed of imitation is measured by the number issues it takes before an imitator completes

its first issue. A security is said to be imitated if a bank other than the innovator underwrites an issue using the same product structure. The dotted line is the CDF corresponding to those imitated securities that were first generation products, i.e., the first product in a sequence of related products. The solid line is the CDF of the speed of imitation of products that appear in the sequence after the first generation product.

Figure 6: Probabilities that a security is not imitated within t days from the date of the first issue ($Pr(N > t)$). This figure shows the probability that a security is not imitated within t days of its first issue, conditional on its generation index. The probability that imitation time, N, occurs after t, i.e., the survival rates $S(t) = \Pr(N > t)$, is measured in the vertical axis and shown as a function of time which is shown in the horizontal axis. The survival rate is given by $S(t) = \Phi(-\frac{1}{\widehat{\sigma}} \ln(\widehat{\lambda} t))$, where $\widehat{\lambda}$ is the estimated imitation hazard rate which is itself obtained from the estimated hazard rate model: $\widehat{\lambda} = \exp(-6.297 + 0.133 * generation + 0.002 * mean\ prior\ issue\ size)$, and $\widehat{\sigma} = 1.273907$. The thick solid line corresponds to the first generation securities. The thin line corresponds to the 5th generation securities and the dotted line to the 10th generation securities.

Figure A2.1: Spatial representation of the issuer's preferences for three competing banks. This figure illustrates the type of imperfect competition in our model for the case of two imitators. Issuers lie inside an equilateral triangle according to their degree of loyalty to each bank. The three underwriters are located at the extremes of the triangle and the position of an issuer relative to the three determines the degree of loyalty of the issuer to them. The more loyal is an issuer to a given bank, the smaller is $x^2 + l^2$ and the more expensive it is to hire any other bank as its underwriter.

Figure A2.2: Areas of potential issuers that each bank can attract. This figure shows the regions in which potential issuers are more loyal to a bank. The dotted lines mark the regions when the innovator does not have an expertise advantage over an imitator and there is equal sharing of the underwriting market. The solid lines mark the regions when the innovator has an expertise advantage over an imitator.

Table I: Summary of all issues of equity-linked and dorporate derivative securities

This table presents summary statistics for all issues of equity-linked and corporate derivative securities. All such issues are recorded by the SDC and span the period between 1985 and 2004. The imitated securities (Panel B) are those that have been underwritten by more that one bank.

Panel A: All issues of all equity-linked and corporate derivatives (sample A)

	Number of observations	Median	Mean	Standard deviation
Proceeds per issue ($ millions)	661	150.00	233.89	299.44
Underwriting fee (percentage of proceeds)	518	3.00	2.41	1.16
Product life (total issues per security)	50	5.50	13.24	20.60

Panel B: All issues of imitated securities (sample B)

	Number of observations	Median	Mean	Standard deviation
Proceeds per issue ($ millions)	410	150.00	257.24	344.74
(t statisitc for $H_0 : \mu_A - \mu_B = 0$)			(-1.17)	
Underwriting fee (percentage)	314	3.10	2.33	1.10
(t statisitc for $H_0 : \mu_A - \mu_B = 0$)			(-0.98)	
Product life	18	13.00	22.78	28.88
(t statisitc for $H_0 : \mu_A - \mu_B = 0$)			(-1.15)	
Time to imitation				
(issues before imitation)	18	2.00	2.67	1.88
(days before imitation)	18	214.50	484.44	642.87
Market share of product innovator	18	0.53	0.57	0.23

[a] Estimates followed by ***, ** and * are statistically different from zero with 0.01, 0.05 and 0.1 significance levels, respectively.

Table II: Classification of equity-linked and corporate derivatives into product groups

This table shows the classification of all 50 equity-linked and corporate derivative securities into product groups. We follow the classification proposed by Schroth (2006) which is based on the structure and purpose of the security. Securities within groups are listed in the order of their appearance along the sequence. The imitated securities are those that have been underwritten by more than one bank. All issues of equity-linked and corporate derivative securities are recorded by the SDC and span the period between 1985 and 2004.

Product Group	Securities in the group	Imitated securities	Underwriters
Debt products	RISRS.	RISRS.	Everen, Kemper.
Zero-coupon convertible debt	LYONS.	LYONS.	Merrill Lynch, Paine Webber.
Dividend paying convertible debt	SIRENS, ICONS.		First Boston, Merrill Lynch.
Convertible preferred products	PERCS, YES Shares, DECS, ACES, X-Caps, PRIDES, PEPS, SAILS, STRYPES, MARCS, PEPS, MEDS, Trust-Originated Convertible Preferreds, TRACES.	PERCS, X-Caps, Trust-Originated Convertible Preferreds.	Baird, Credit Suisse, DLJ, Dean Witter, Goldman Sachs, JP Morgan, Lazard Fréres, Lehman Brothers, Merrill Lynch, Morgan Stanley, Paine Webber, Robertson, Salomon-Smith Barney, UBS.
Short-term, income deferring products	FRAPS.	FRAPS.	DLJ, Lehman Brothers, Merrill Lynch, Morgan Stanley.
Perpetual, income deferring products	MIPS, EPICS, MIDS, TOPRS, QUIDS, QUIPS, QUICS, Res-Caps, COPRS.	MIPS, MIDS, TOPRS, QUIDS, Res-Caps.	Bear Stearns, Goldman Sachs, Lehman Brothers, Merrill Lynch, Morgan Stanley-Dean Witter, Salomon Brothers, Smith-Barney, UBS.
Convertible, income deferring products	Convertible MIPS, TECONS, Convertible TOPRS, QDCs, EPPICS, TRUPS, Convertible QUIPS.	Convertible TOPRS, TRUPS.	First Union Capital, Goldman Sachs, JP Morgan, Keefe, Merrill Lynch, Morgan Stanley, Paine Webber, Salomon-Smith Barney.
Index-tied appreciation of principal	PERLS, SIRS, MITTS, SMARTS, Equity Participation Securities, CPNs, SUNS, CUBS.	PERLS, SIRS, SMARTS, Equity Participation Securities.	Bear Stearns, Goldman Sachs, Lehman Brothers, Merrill Lynch, Morgan Stanley, Paine Webber.
Stock-tied appreciation of principal	ELKS, YEELDS, CHIPS, PERQS.	ELKS.	Bear Stearns, Lehman Brothers, Morgan Stanley, Salomon-Smith Barney.
Privatization exchangeable debt	PENs.		Goldman Sachs.
Corporate pass-throughs	STOPS.		Deutsche Bank.

Table III: Comparison of issues of equity-linked and corporate derivative securities across generations

This table compares issues of first and later generation equity-linked and corporate derivative securities. All such issues are recorded by the SDC and span the period between 1985 and 2004. First generation securities are those that appear first in the sequence of innovation within each product group (Table II). The imitated securities (Panel B) are those that have been underwritten by more that one bank.

Panel A: All issues of all equity-linked and corporate derivatives

	Number of observations	Median	Mean	Standard deviation
Proceeds per issue ($ millions)				
of first generation securities (1)	218	150.00	297.50	438.61
of later generations (2)	443	150.00	201.39	190.74
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(3.92)***	
Underwriting fee (percentage)				
of first generations (1)	163	1.25	1.72	1.07
of later generations (2)	355	3.15	2.77	1.01
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(−10.79)***	
Product life (issues per security)				
of first generations (1)	11	9.00	19.81	28.16
of later generations (2)	39	5.00	11.39	18.47
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(1.18)	

Panel B: All issues of imitated securities

	Number of observations	Median	Mean	Standard deviation
Proceeds per issue ($ millions)				
of first generation securities (1)	205	150.00	300.75	449.19
of later generations (2)	205	150.00	213.73	180.81
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(2.57)***	
Underwriting fee (percentage)				
of first generations (1)	154	1.19	1.70	1.09
of later generations (2)	160	3.15	2.94	0.69
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(−12.12)***	
Product life (issues per security)				
of first generations (1)	7	17	29.26	32.10
of later generations (2)	11	7	18.64	27.40
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(−0.75)	
Time to imitation (issues before imitation)				
of first generations (1)	7	3	3.86	3.53
of later generations (2)	11	2	1.91	0.83
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(1.79)**	
Time to imitation (days before imitation)				
of first generations (1)	7	231	320.86	355.75
of later generations (2)	11	198	588.55	772.01
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(−0.85)	
Market share of innovator				
of first generations (1)	7	0.70	0.69	0.20
of later generations (2)	11	0.50	0.49	0.21
T statisitc for ($H_0 : \mu_1 - \mu_2 = 0$)			(2.07)**	

[a] Estimates followed by ***, ** and * are statistically different from zero with 0.01, 0.05 and 0.1 significance levels, respectively.

Table IV: Issuers' loyalty to underwriters

This table summarizes the issuers' loyalty measure. The relative issuer loyalty at each issue t of security g is measured by the propensity that the issuer, x, has had in the past to choose bank b over its rivals b' to underwrite g. The index is

$$LOYAL_{t,g,b,x} = \frac{\#(\text{issues between } x \text{ and } b)}{\sum_{\forall b' \text{in market } g} \#(\text{issues between } x \text{ and } b')} - \frac{1}{\#(b' \text{ in market } g)},$$

where #(issues between x and b) is the total number of past issues of any security since 1985 with the same issuer-underwriter pair; $\sum_{\forall b' \text{in market } g} \#(\text{issues between } x \text{ and } b')$ is the sum of these counts for the same issuer over all banks that compete for security g and #(b' in market g) is the number of such banks.

	Number of observations	Median	Mean	Standard deviation
LOYALTY				
overall	328	0.000	0.096	0.251
in the same product class	334	0.000	0.075	0.234
Overall *LOYALTY*				
to the innovator (IN)	302	0.000	0.100	0.246
to imitators (IM)	26	0.000	0.053	0.303
T statisitc for ($H_0 : \mu_{IN} - \mu_{IM} = 0$)			(0.92)	
Within the class *LOYALTY*				
to the innovator (IN)	302	0.000	0.080	0.232
to imitators (IM)	26	0.000	0.021	0.259
T statisitc for ($H_0 : \mu_{IN} - \mu_{IM} = 0$)			(1.23)	

[a] Estimates followed by ***, ** and * are statistically different from zero with 0.01, 0.05 and 0.1 significance levels, respectively.

Table V: Estimates of the imitation hazard rates model

This table shows the estimates of a model of the hazard rate of imitation of innovative securities. The estimation uses all issues before imitation of all imitated equity-linked and corporate derivative securities in SDC between 1985 and 2004. Every issue of every imitated security before imitation is paired with its issue number and covariates. The model estimated with this data is

$$\lambda_{g,t} = \exp\{-(\beta_0 + \beta_1 g + \boldsymbol{\beta}_2' \mathbf{x}_{g,t} + \varepsilon)\};$$

where $\lambda_{g,t}$ is the probability that security g is imitated immediately after issue t given that it has not yet been imitated. $\mathbf{x}_{gt}$ includes characteristics of the market for security g specified below. The parameters β_0, β_1, and β_2 are estimated by maximum likelihood, using standard errors estimators that are robustly consistent to heteroskedasticity and correlation within securities in the same group. Standard errors are shown in brackets under the estimate. ε is assumed to be log-normally distributed. The estimates in Panel B corresponds to the same model where the time index, t, is measured in calendar time (days).

Panel A: Time to imitation measured by issue number

	(1)	(2)	(3)	(4)	(5)	(6)
Generation number	−0.072	−0.061	−0.064	−0.069	−0.067	−0.064
(g)	(0.029)**	(0.027)**	(0.027)**	(0.031)**	(0.030)**	(0.029)**
Total volume issued		8.980				
($ trillions)		(2.46)***				
Total number of			0.006			
issues			(0.002)***			
Size of first issue				0.490		
($ billions)				(0.275)*		
Average size of previous					0.602	0.007
issues ($ billions)					(0.353)*	(0.026)
Standard deviation of previous						0.964
issues size ($ billions)						(0.378)**
Constant	1.455	1.340	1.279	1.294	1.304	1.343
	(0.167)***	(0.171)***	(0.179)***	(0.218)***	(0.215)***	(0.214)***
Observations	48	48	48	48	48	48
χ^2 statistic	5.98	40.46	64.83	15.16	11.02	21.31
P-value of χ^2 statistic	0.000	0.000	0.000	0.000	0.000	0.000

Panel B: Time to imitation measured in days

	(1)	(2)	(3)	(4)	(5)	(6)
Generation number	−0.130	−0.137	−0.142	−0.140	−0.133	−0.146
(g)	(0.047)***	(0.045)***	(0.039)***	(0.061)**	(0.063)**	(0.073)**
Total volume issued		−5.750				
($ billions)		(6.453)				
Total number of			−0.009			
issues			(0.007)			
Size of first issue				−0.001		
($ millions)				(0.001)**		
Average size of previous					−0.002	−0.002
issues ($ millions)					(0.001)***	(0.000)***
Standard deviation of previous						−0.002
issues size ($ billions)						(0.002)
Constant	5.822	5.895	6.079	6.296	6.297	6.481
	(0.192)***	(0.223)***	(0.314)***	(0.320)***	(0.268)***	(0.389)***
Observations	48	48	48	48	48	48
χ^2 statistic	7.57	12	33.01	7.88	9.64	18.01
P-value of χ^2 statistic	0.006	0.002	0	0.019	0.008	0

[a] Estimates followed by ***, ** and * are statistically different from zero with 0.01, 0.05 and 0.1 significance levels, respectively.

Table VI: Economic significance of the estimates of the imitation hazard rates model

This table shows the estimated times of imitation, implied by the estimates in Table V. The predicted median time for the imitators entry is $\frac{1}{\hat{\lambda}}$, where

$$\hat{\lambda} = \exp(-(\hat{\beta}_0 + \hat{\beta}_1 g + \hat{\boldsymbol{\beta}}_2' \mathbf{x}_{g,t})).$$

Panel A: Time to imitation measured by issue number

The estimated model used to predicted the median imitation issue number is

$$\hat{\lambda} = \exp(-1.304 + 0.067 \times g + 0.602 \times \text{average size of previous issues}).$$

Moments of the sample distribution of the average previous issue size	Generation			
	1st	5th	10th	15th
1st quartile	3.627	2.776	1.988	1.423
	(0.612)***	(0.266)***	(0.310)***	(0.410)***
Median	3.842	2.941	2.105	1.507
	(0.566)***	(0.200)***	(0.316)***	(0.437)***
Mean	4.005	3.066	2.195	1.571
	(0.541)***	(0.161)***	(0.330)***	(0.461)***
3rd quartile	4.385	3.356	2.403	1.72
	(0.533)***	(0.177)***	(0.395)***	(0.530)***

Panel B: Time to imitation measured in days

The estimated model used to predicted the median imitation time, in days, is

$$\hat{\lambda} = \exp(-6.297 + 0.133 \times g + 0.002 \times \text{average size of previous issues}).$$

Moments of the sample distribution of the average previous issue size	Generation			
	1st	5th	10th	15th
1st quartile	411.292	241.341	123.946	63.655
	(81.107)***	(61.065)***	(64.620)*	(52.320)
Median	349.547	205.11	105.339	54.099
	(56.289)***	(52.497)***	(56.859)*	(45.686)
Mean	310.766	182.354	93.652	48.097
	(44.063)***	(48.288)***	(52.060)*	(41.483)
3rd quartile	240.643	141.207	72.52	37.244
	(32.000)***	(42.457)***	(43.372)*	(33.745)

[a] Estimates followed by ***, ** and * are statistically different from zero with 0.01, 0.05 and 0.1 significance levels, respectively.

Table VII: Estimates of the equilibrium underwriting fee model's parameters

This table shows the estimates of the parameters of the equilibrium underwriting fee model, where the fee for issue t of a generation g security is

$$p_{t,g} = \gamma_0 + \gamma_1 INN_b + \gamma_2 INN_b \times t \times g + \sigma LOYAL_{t,g,b,x} + \boldsymbol{\delta}'_w \mathbf{w}_t + \boldsymbol{\delta}'_z \mathbf{z}_{b,t} + \upsilon_l + \eta_{t,g}.$$

and $INN_b = 1$ if the underwriter of issue t is the security's innovator and -1 otherwise; $LOYAL_{t,g,b,x}$ measures the past likelihood of the issuer to choose underwriter b by the time of issue t of security g;the vectors w_t and $z_{b,t}$ include issue-specific and bank-specific controls, respectively, and are listed below. The term υ_l captures class-specific pricing differences, where $l = \{$Debt (D), Convertible debt (CD), Preferred (P) and Convertible preferred (CP)$\}$. We estimate υ_l and the parameters with a random (RE) and a fixed effects estimator and report the RE estimates, their standard errors (underneath, in brackets), and the Hausman test statistic. The data includes all 237 issues of the 18 imitated equity-linked and corporate derivatives in the SDC data between 1985 and 2004.

Parameter	(1)	(2)	(3)	(4)	(5)	(6)
γ_1	0.323	0.208	0.209	0.386	0.258	0.259
	(0.117)***	(0.112)*	(0.112)*	(0.118)***	(0.114)**	(0.114)**
γ_2	−0.020	−0.022	−0.023	−0.021	−0.023	−0.023
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
σ, where $LOYALTY$ is:						
(i) based on all same bank-issuer pairs in the past	0.167	0.147		0.175	0.164	
	(0.219)	(0.205)		(0.224)	(0.210)	
(ii) based on all same bank-issuer pairs in the same class as g			0.135			0.172
			(0.217)			(0.222)
$\boldsymbol{\delta}_w$						
Logarithm of proceeds ($ million)	−0.080	−0.099	−0.101	−0.089	−0.123	−0.125
	(0.072)	(0.071)	(0.071)	(0.074)	(0.073)*	(0.073)*
Maturity (in years, D and CD only)	0.007	−0.002	−0.002	0.003	−0.004	−0.005
	(0.010)	(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
Investment grade? (1 if yes, 0 if no, D and CD)	−0.704	−0.272	−0.268	−0.623	−0.183	−0.178
	(0.162)***	(0.168)	(0.168)	(0.167)***	(0.172)	(0.172)
Share of equity-linked issues by this bank	−2.278	−1.101	−1.122	−2.496	−1.394	−1.426
	(0.313)***	(0.414)***	(0.412)***	(0.322)***	(0.486)***	(0.482)***
$\boldsymbol{\delta}_z$						
Share of all issues in the same class as g by this bank	1.259	1.137	1.138	1.079	1.137	1.128
	(0.391)***	(0.606)***	(0.606)***	(0.401)***	(0.720)***	(0.718)***
Year dummies (1986-2003)	No	Yes	Yes	No	Yes	Yes
γ_0	3.400	2.107	2.130	3.550	2.596	2.636
	(0.466)***	(0.493)**	(0.495)**	(0.490)**	(0.537)**	(0.540)**
Observations	273	273	273	256	256	256
R^2	0.465	0.583	0.582	0.487	0.605	0.605
Wald test χ^2 statistic	229.041	344.684	344.380	234.890	352.653	352.609
P-value	0.000	0.000	0.000	0.000	0.000	0.000
Hausman test statistic	69.435	30.894	30.795	64.604	24.486	24.471
P-value	0.000	0.193	0.196	0.000	0.491	0.492

[a] Estimates followed by ***, ** and * are statistically different from zero with 0.01, 0.05 and 0.1 significance levels, respectively.

Table VIII: Economic significance of the estimates of the pricing equation

This table shows the estimates of the expected duration of the innovator's advantage implied by the estimates of the underwriting fee model reported in Table VII. The expected advantage duration for security g is the number of issues after which the innovator and imitators compete at equal strentgh. The estimated advantage is

$$\Delta q\,(g,t) = \hat{\gamma}_1 INN_b + \hat{\gamma}_2 INN_b \times t \times g,$$

and it lasts for $t = -\frac{\hat{\gamma}_1}{\hat{\gamma}_2 g}$ issues. Each column uses the estimates of the corresponding column of Table VII.

	$-\frac{\hat{\gamma}_1}{\hat{\gamma}_2 g}$					
Generation	(1)	(2)	(3)	(4)	(5)	(6)
1	16.036	9.323	9.282	18.661	11.428	11.375
	(5.912)***	(4.923)*	(4.886)*	(5.904)***	(4.978)**	(4.94)**
5	3.207	1.865	1.856	3.732	2.286	2.275
	(1.182)***	(0.985)*	(0.977)*	(1.181)***	(0.996)**	(0.988)**
10	1.604	0.932	0.928	1.866	1.143	1.138
	(0.591)***	(0.492)*	(0.489)*	(0.59)***	(0.498)**	(0.494)**
15	1.069	0.622	0.619	1.244	0.762	0.758
	(0.394)***	(0.328)*	(0.326)*	(0.394)***	(0.332)**	(0.329)**

[a] Estimates followed by ***, ** and * are statistically different from zero with 0.01, 0.05 and 0.1 significance levels, respectively.

Table IX: Estimates of the equilibrium underwriting fee model's parameters

This table shows the estimates of the parameters of the equilibrium underwriting fee model. For columns 1 to 3, the fee for issue t of a generation g security is

$$\begin{aligned} p_{t,g} &= \gamma_0 + \sigma LOYAL_{t,g,b,x} + \boldsymbol{\delta}'_z \mathbf{z}_{b,t} + \upsilon_l \\ &+ I_{\{t>1\}} \times \left[\gamma_1 INN_b + \gamma_2 INN_b \times t \times g + \boldsymbol{\delta}'_w \mathbf{w}_t\right] + \eta_{t,g}, \end{aligned}$$

where $INN_b = 1$ if the underwriter of issue t is the security's innovator and -1 otherwise; $LOYAL_{t,g,b,x}$ measures the past likelihood of the issuer to choose underwriter b by the time of issue t of security g;the vectors w_t and $z_{b,t}$ include issue-specific and bank-specific controls, respectively, and are listed below; $I_{\{t>1\}} = 1$ for all issues after the first, and zero otherwise.The term υ_l captures class-specific pricing differences, where $l = \{$Debt (D), Convertible debt (CD), Preferred (P) and Convertible preferred (CP)$\}$. For columns 4 to 6, the fee for issue t of security g is

$$\begin{aligned} p_{t,g} &= \gamma_0 + \gamma_1 INN_b + \gamma_2 INN_b \times t \times g + \sigma LOYAL_{t,g,b,x} + \boldsymbol{\delta}'_w \mathbf{w}_t + \boldsymbol{\delta}'_z \mathbf{z}_{b,t} + \upsilon_l \\ &+ \delta_\lambda \lambda\left(t, \boldsymbol{\beta}'\mathbf{x}_g\right) + \tilde{\eta}_{t,g}, \end{aligned}$$

where $\lambda\left(t, \boldsymbol{\beta}'\mathbf{x}_g\right) = -\frac{\phi\left(\frac{1}{\hat{\sigma}}\left(\ln t - \hat{\boldsymbol{\beta}}'\mathbf{x}_g\right)\right)}{\Phi\left(\frac{1}{\hat{\sigma}}\left(\ln t - \hat{\boldsymbol{\beta}}'\mathbf{x}_g\right)\right)}$ is the inverse mills ratio derived from the hazard rate model of the time to imitation in column 4 of Table V. We estimate υ_l and the parameters with a random (RE) and a fixed effects estimator and report the RE estimates, their standard errors (underneath, in brackets), and the Hausman test statistic. The data includes all 237 issues of the 18 imitated equity-linked and corporate derivatives in the SDC data between 1985 and 2004. The first model is estimated with the full sample and the second with all issues after imitation has occured.

Parameter	(1)	(2)	(3)	(4)	(5)	(6)
γ_1	0.378	0.244	0.245	0.327	0.269	0.277
	(0.120)***	(0.111)**	(0.111)**	(0.125)***	(0.113)**	(0.112)**
γ_2	−0.024	−0.025	−0.025	−0.017	−0.022	−0.022
	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
σ, where $LOYALTY$ is:						
(i) based on all same bank-issuer	0.128	0.107		0.329	0.163	
pairs in the past	(0.218)	(0.197)		(0.162)**	(0.140)	
(ii) based on all same bank-issuer			0.096			0.197
pairs in the same class as g			(0.207)			(0.152)
$\boldsymbol{\delta}_w$						
Logarithm of proceeds	−0.074	−0.071	−0.071	0.055	−0.058	−0.060
($ million)	(0.047)	(0.043)*	(0.043)*	(0.061)	(0.056)	(0.056)
Maturity (in years,	−0.994	−1.384	−1.381	−0.006	−0.004	−0.005
D and CD only)	(0.580)*	(0.528)***	(0.528)***	(0.008)	(0.007)	(0.007)
Investment grade? (1 if yes,	2.296	4.068	4.054	−0.450	−0.109	−0.102
0 if no, D and CD)	(2.257)	(2.087)*	(2.086)*	(0.121)***	(0.113)	(0.113)
Share of equity-linked issues	−2.729	−1.276	−1.292	−2.79	−1.459	−1.529
by this bank	(0.308)***	(0.409)***	(0.407)***	(0.254)***	(0.396)***	(0.395)***
$\boldsymbol{\delta}_z$						
Share of all issues in the same	1.675	1.240	1.239	1.396	1.643	1.619
class as g by this bank	(0.434)***	(0.438)***	(0.440)***	(0.366)***	(0.371)***	(0.373)***
Year dummies (1986-2003)	No	Yes	Yes	No	Yes	Yes
δ_λ				2.858	−0.009	0.014
(inverse Mills ratio)				(1.133)**	(1.122)	(1.122)
γ_0	2.951	1.673	1.686	1.956	2.197	2.263
	(0.149)***	(0.499)***	(0.498)***	(0.540)***	(0.653)***	(0.649)***
Observations	273	273	273	207	207	207
R^2	0.453	0.602	0.602	0.692	0.805	0.805
Wald test χ^2 statistic	218.360	374.050	373.850	483.430	816.580	818.290
P-value						
Hausman test statistic	18.168	25.136	25.234	88.657	29.246	28.924
P-value	0.020	0.455	0.449	0.000	0.211	0.223

[a] Estimates followed by ***, ** and * are statistically different from zero with 0.01, 0.05 and 0.1 significance levels, respectively.

Table X: Further evidence

Panel A of this table shows the frequencies of imitated and non-imitated securities conditional on whether or not they are the first generation in their group. There are 50 equity-linked and corporate derivative securities in the SDC and of these, 11 are first generation products. The χ^2 Pearson statistic is computed under the null hypothesis is that there is no statistical association between whether the security is imitated or not and whether the security is a first generation or not. Panel B shows the distribution of the number of times that a bank innovates along a given sequence of products conditional on whether or not the bank was the first innovator of the group. There are 61 bank-product group pairs for all the 50 equity-linked and corporate derivative securities in the SDC and, of these pairs, 11 correspond to the banks that developed the first generation product in each group. The rest correspond to the banks that competed in the same group either as imitators or as innovators of later generation products.

Panel A: was the security imitated?

		No	Yes	Total
First generation securities	Number	4	7	11
	Percentage	36.36%	63.64%	
Later generation securities	Number	29	11	39
	Percentage	74.36%	25.64%	

χ^2 Pearson statistic = 4.9332; P-value = 0.026.

Panel B: do innovators persist?

		Number of subsequent innovations by the bank in the same group					
		0	1	2	3	4	Total
Banks that are the group innovator	Number	28	16	3	1	2	50
	Percentage	56.00%	32.00%	6.00%	2.00%	4.00%	
Banks that are not the group innovator	Number	0	8	1	1	1	11
	Percentage	0.00%	72.73%	9.09%	9.09%	9.09%	

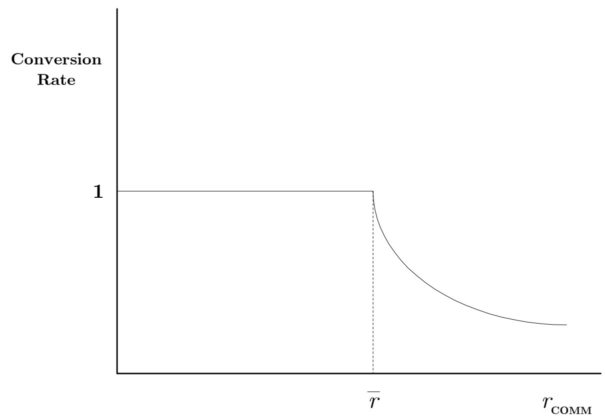

Figure 1: The conversion rate of a Preferred Equity Redeemable Stock (PERCS) as a function of the returns of the underlying common stock.

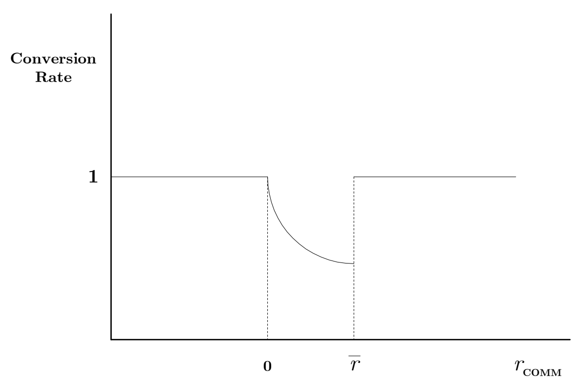

Figure 2: The conversion rate of a Dividend Enhanced Convertible Stock (DECS) as a function of the returns of the underlying common stock.

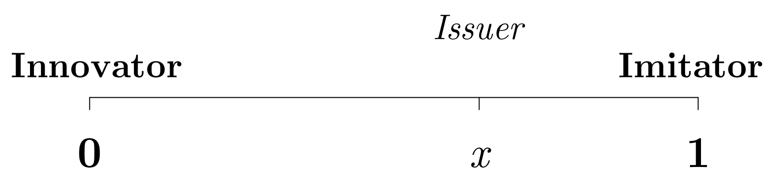

Figure 3: Spatial representation of the issuer's preferences for two competing banks.

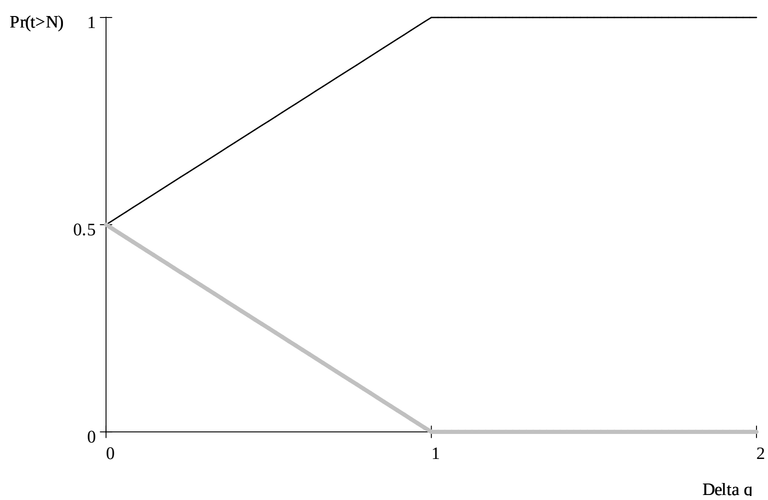

Figure 4: Probability that the underwriter of the next issue is the product innovator (black line) or its imitator (gray line) as a function of the quality differential (Δq).

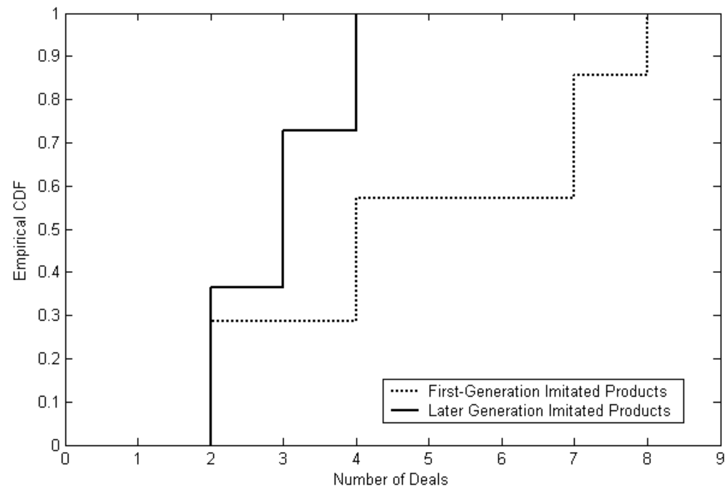

Figure 5: Empirical cumulative distribution function of the speed at which a security is imitated.

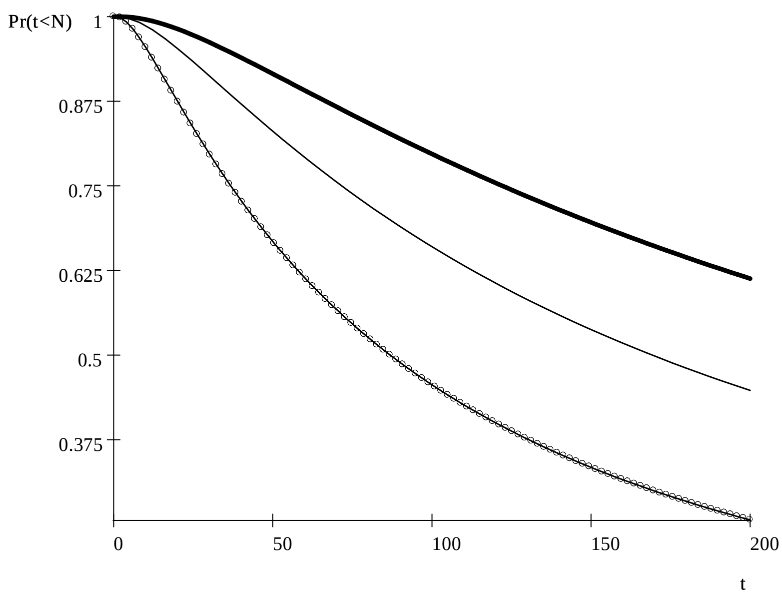

Figure 6: Probabilities that a security is not imitated within t days from the date of its first issue ($Pr(N > t)$). The thick solid line corresponds to first generation securities. The thin line corresponds to 5th generation securities and the dotted line to 10th generation securities.