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Innovation and First-Mover Advantages in Corporate Underwriting: Evidence from Equity Linked Securities

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Abstract

Investment banks develop new securities permanently even when their competitors can imitate them almost immediately and at significantly smaller development costs. Using data of all the new issues of Equity Linked and Derivative Securities since 1985 compiled by SDC, and firm financial data from COMPUSTAT, I test if innovators have a demand advantage over the imitators when they compete to underwrite new issues using innovative corporate products. If the innovator has private information about the innovation, his own variety of the security may be better valued than the imitators' varieties by the issuers. I estimate the issuers' demand for the banker's underwriting service across different varieties of equity-linked securities. Using a nested-logit model of discrete choice I find that, ceteris paribus, the demand for innovators' varieties is larger than for imitators'. I also find that this demand advantage is decreasing in time, suggesting that imitators learn from observing deals made in the past by the innovator and by themselves. The initial innovator's advantage is larger for securities that appear later in a sequence of innovations but it diminishes faster.

JEL classification: G24, C25, L89.

Keywords: Financial Innovation, Investment Banking, Underwriting, First-Mover Advanatges, Demand Estimation.

1 Introduction

The last twenty years have witnessed the introduction of a remarkable number of innovations in corporate securities.[1] Most of these have been brought about by investment banks through the business of underwriting new corporate issues. It is also remarkable that investment banks have found it profitable to develop new securities even when their competitors have been able to imitate them almost immediately and at significantly smaller development costs. The empirical evidence so far has suggested that, despite these disadvantages, innovators are compensated with the largest share of the underwriting market. In this paper I estimate the demand of firms for the underwriting services of investment banks that use innovative corporate products. This will allow me to measure the different value to firms from raising money using a security engineered by an innovator or an imitator and thus explain the innovator's market share advantage. The dynamic setup of the econometric model will allow a characterization of this advantage over time and shed light on the question of what makes innovators have a demand advantage over imitators.

Product innovation in finance is particularly interesting because innovators face many disadvantages. Tufano (1989) provides evidence showing that imitation occurs shortly after the first issue of a new security, leaving virtually no time for innovators to be the sole underwriters for that new type of security. He also observes that the development cost is significantly smaller for imitators than for innovators. Further, the design of new securities is rapidly revealed to competing banks because of SEC rules of disclosure. Most strikingly, imitation cannot be precluded by any form of legal protection, i.e., patents.

In his seminal contribution, Tufano (1989) observes that what compensates innovators for these disadvantages is the largest share of the market for underwriting corporate new issues: given a security, the bank that creates it is able to underwrite more capital than its largest imitator over all the security's history. Why innovators are able to have such an unchallenged lead in these markets is perhaps the first question that this evidence raises. This paper takes the first step towards answering the question empirically. For that purpose I model the choice of a firm that needs to raise money externally through the issue of a security. This firm has to choose the type of security to be used and the bank that will underwrite it. Aggregating the choices of all the firms that need to make an offering, the model predicts the

[1] For a list of innovations in corporate securities until 1991, and a description of some of them, see Finnerty (1992). All innovations in equity-linked and derivative corporate securities until March 2001 are listed in this paper.

market shares of underwriting by different banks using different securities conditional, among other things, on the characteristics of the banks (e.g., if they are imitators or innovators). Thus, after estimating this model, we can test whether innovators have an advantage because their security is more valuable to issuers.

This paper introduces two features that allow us to get a better description of the facts of financial innovation. One of them is the use of a framework of differentiated products to model and estimate the demand for underwriting services. An inspection of recent innovations in corporate products suggests clearly that different securities are created to target different types of issuers or investors. For example, two similar debt products that tie the repayment of the principal to the performance of other indices provide different hedging devices to investors: the Stock Market Annual Reset Term Notes (SMARTs) are corporate bonds that pay a capped floating rate that is tied to the American Stock Exchange Oil Stocks Index while the Currency Protected Notes (CPNs) are bonds that pay a floating rate that is inversely tied to the Canadian six-month bankers acceptance rate. By taking into account the location of securities in a product space, it is possible to identify consistently a demand function for underwriting that depends on the price of underwriting (the underwriting spread).[2] This is possible because we can associate the variation in market shares with the variation in underwriting spreads of varieties of the same security by different banks, and the variation in underwriting spreads of similar varieties which can be close substitutes.[3]

The other feature is that this study focuses also on the dynamic pattern of market shares. Instead of comparing the market shares of innovators and imitators over the whole history of a given innovation, I observe them over time and estimate the innovator's demand advantage accordingly. This will reveal whether the innovator's advantage is preserved steadily through the life cycle of the security or if imitators catch up with (or continue to fall behind) innovators. This dynamic setup also allows a comparison between the demands for sequences of securities. In fact, most securities appear sequentially, later ones as improvements of earlier ones. It appears that the life cycle of a security ends when an innovation that modifies the older design is introduced.

The empirical finance literature has not yet addressed extensively the

[2] The underwriting spead is the fee charged by an investment bank or a syndicate, equal to the difference between the gross sales to investors and the net proceeds received by the issuer.

[3] Tufano's study, for example, compares spreads only between banks issuing the same security. In that sense, it is not a demand estimation for the underwriting services of banks across different securities.

question of why innovators have advantages over imitators. In fact, most authors have examined extensively the *causes* of the demand for innovative securities. The focus has been on trying to explain what made each particular innovation attractive to investors or issuers but not on why it is privately profitable to develop such instruments. Miller (1986), for example, argues that the major impulse to financial innovations between the sixties and the eighties came from ever changing tax codes and regulations that brought about profit opportunities (e.g., tax money saved) through the design of new financial products that circumvented these laws.[4]

Not much work has been done, though, to try to solve the puzzle of *why* an unpatentable innovation is worth its R&D expenditure if imitation is less costly and immediate. In particular, not much has been said about what gives innovators an advantage over imitators. On one hand, some authors have tried to explain Tufano's stylized facts at the theoretical level by arguing that innovators are infra-marginal competitors, i.e., that have lower marginal costs than imitators. By moving first, innovators may face lower search costs of identifying potential issuers and investors (Allen and Gale, 1994, Chapter 4) or lower average marketing costs if there is lumpiness in the set up costs of marketing networks (Ross, 1989) or if innovation signals skill and creativity credibly (Tufano, 1989). On the other hand, Battacharyya and Nanda (2000) provide a model in which the innovator is able to appropriate the value of its innovation and profit from it despite being imitated if it is costly for its clients to switch to other underwriters.[5,6]

By contrast with these views, I analyze the possibility that the asymmetry between innovators and imitators is on the information owned by these two types of banks. If some of the information that innovators have about the security remains private, a larger proportion of the R&D added value can be appropriated. In other words, the innovator can profit because it is imitated imperfectly. This possibility was explored in a theoretical paper by Herrera and Schroth (2000). In it, innovators of derivatives that move one period in advance receive private informative signals from their clients or the

[4]Tufano (1995) and Finnerty (1992) also describe the reasons for the appearance of the most important innovations between 1830 and 1930 and since the 1970s, respectively.

[5]According to anecdotal evidence gathered by Naslund (1986), though, firms usually turn to the services of expert issuers of innovative products, i.e., innovators, even if they used another bank for other services. This evidence comes from the testimonies of twenty financial product developers in New York.

[6]Black and Silber (1986) also study first-mover advantages in finance but they focus in futures exchanges as the innovators, not in investment banks. They claim that futures exchanges that develop new contracts have the advantage that they provide liquidity for investors earlier than the competing exchanges so they are able to attract agents that have to choose where to trade.

market. This allows them to offer deals that are more attractive to firms than what imitators can offer. For recent innovations in corporate securities, it is possible that imitation is imperfect. Equity-Linked securities and other derivative corporate products are sophisticated securities, specified by many parameters, some of which vary from deal to deal. Thus, it is possible that imitators cannot reverse-engineer perfectly the observed new securities from only a few deals. For example, the Equity-Linked Note (ELK) was the first debt product to tie the repayment of principal to the stock price of another publicly traded company. The optimal choice of the stock of the company to tie the notes to is observable but the knowledge of what stocks are optimal for different issuers or investors is a private component of R&D. Imitators that want to underwrite issues of ELKs for a potential client may know how to structure such instruments, but may not know exactly, from what is observable, what stock to choose to tie the repayment of the debt of their client.

Using data on all the new issues of equity-linked and corporate derivative securities, the (qualitative) results of the estimation of the demand for underwriting services can be summarized as follows:

- the demand for underwriting services using this type of securities *is* sensitive to the underwriting spread (i.e., its price);
- on average, the firms' demand for an innovator's variety of the security is bigger than the one for imitators;
- this difference disappears during the security's life cycle, so imitators catch up with innovators;
- imitators catch up with innovators faster if securities are later improvements on past innovations.

Thus, this paper provides the first empirical test that the advantage to innovators may come from a bigger demand for the innovators' products. The dynamic patterns of competition it identifies are consistent with the predictions of Van Horne (1985) when imitators enter the market.[7] They are also consistent with the hypothesis that the advantage to innovators is superior information that allows them to engineer their securities better than imitators.

In the next section of the paper I describe the data set I use and present some preliminary results that motivate the assumptions of the model I will

[7]Kanemasu, Litzenberger and Rolfo (1986) observe the same pattern for the case of stripped treasury securities.

take to the data later. In Section 3 I develop the model that will allow me to characterize the preferences of firms for the different types of underwriters (innovators and imitators). In the theory subsection I present the formal setup for the discrete-choice decision problem of firms. I show that firms should derive additional value if they chose an innovator rather than imitators as their underwriter. The rest of the section explains how this conjecture will be tested using multinomial logit and nested logit models of demand. In Section 4 I present the results of the estimation and Section 5 summarizes the main claims of the paper.

2 Some Preliminary Evidence

The data used in this research is obtained from the Securities Data Company's online databases of financial transactions. I use all the private and public offerings of equity-linked and derivative corporate securities in the New Issues database and record as many details of the offer as possible: the name of the issuer, the principal issued, the name of the underwriter, the underwriter's fees (underwriting spread), and details of the security, like offered yield to maturity, average life, spread of coupon over treasury notes, call options, etc. I merge this data set with the quarterly COMPUSTAT database (using six digit CUSIP numbers) to have financial information about the issuer.

In his study, Tufano (1989) uses all types of securities between 1974 and 1986. Here I restrict the sample to equity-linked securities because this type fits better the motivation that first-mover advantages come from information asymmetries between underwriters. This type of securities are complex and underwriters have to choose many parameters to engineer such deals (In Table 1 I show the relative size of this market). Variations on mortgage backed products, for example, may be already too familiar to investment banks to hide something in their structure to imitators.

Below I describe some important facts observed for this type of securities. I pay particular attention to the evolution of market shares in the markets of initial offerings.

The first thing to realize is that all the securities in our sample can be classified into groups. The SDC database identifies 50 different types of new equity-linked or derivative corporate securities but a closer look indicates that some of these securities are related to each other in terms of their structure and purpose. For example, MIPS and TOPRS are instruments used by issuers to deduct debt interest payments from their taxable income, but the former are issued by a limited liability company while the latter by a specially conformed business trust.[8] To classify all the 50 corporate products in the SDC database I have relied on the experts' opinion about the uses of these products for corporations and investors.[9] I found eleven distinct categories, which I summarize in Table 2. For the rest of the paper I will refer to these categories as "groups" or "families" of securities interchangeably.

I will refer to each one of these securities as an innovation, since for each one there is a unique feature that distinguishes it from everything that already existed. However, depending on the group they are in and the order in which they appeared, I will assign to each security a generation number. For example, since MIPS were the first tax advantage preferred debt, I will call them the first generation of this family, and TOPRS the fourth.

I follow Tufano's (1989) criterion to define the innovator of a security as the underwriter of the first public offer using that security. Similar to what Tufano found, for equity-linked corporate securities we do observe that innovators have an edge over imitators in terms of market shares. Only 18 of the 50 products are imitated. In 13 of these, innovators lead in principal underwritten, and in 15 they lead in number of new issues. Also, imitation was fast: for 10 of these securities, the second underwriting deal was made by an imitator (see Table 3).

In this paper I want to study why innovators have a competitive advantage over imitators. In particular, I want to test if issuers have stronger preferences for innovators than imitators as the underwriter of the offer. To choose an appropriate framework to study the demand for the underwriter of the issue it is worth examining the dynamics of the market for a new issue within each security and within each family. In Figures 1 and 2 I show the total quarterly principal underwritten by investment banks using the most important securities of two families. As we can see, each security seems to be popular for a certain period of time until a next generation appears and leads the market for issues of that group.

Another interesting feature for some families is that the market share advantage of innovators over imitators seems to be bigger in the early generations. In figures 3 through 5 I show the evolution in time of the accumulated underwritten principal using a given security. Each figure represents a generation of the same family (convertible preferred stocks). For later generations, imitators end up accumulating a larger principal relative to the innovator.

[8] See Pratt (1995) for a detailed comparison of MIPS and TOPRS.

[9] For every product I have compiled articles in Investment Dealers' Digest, American Banker, Dow Jones Newswires and others found using the ABI Search Engine. For every one I was able to find a description of the product, and a reference to an older product which was similar to it. I am especially indebted to Tom Pratt, who writes a descriptive article of almost every corporate security invented.

In some cases the innovator is overtaken. A similar feature is observed in the family of index-tied principal appreciation securities (figures 6 and 7). It is less clear, though, if this is true for other families, like the tax-advantage debt or equity products. On average, still, it seems the innovators's advantage is weaker on late generations: Table 4 shows the average ratios of principal underwritten by imitators relative to principal underwritten by innovators. The ratio for first generation securities is half the ratio that includes all imitated securities.

The evidence above suggests that innovators seem to have an advantage over imitators that is stronger for earlier generations of securities within the family. Further inspection suggests that the appropriate framework to analyze the securities in this sample may be one of differentiated products: it is clear from an inspection of the definition of the 50 securities that these corporate products offer different benefits to issuers or investors. Some provide a tax-advantage, others provide a hedge against the risk of defaulting on debt. Interestingly, within imitated securities there seems to be differentiation across underwriters. Some of the characteristics of the same securities (e.g., yield, offer to yield at maturity, years of call option protection, etc.) differ significantly across the banks that underwrote the offer (Table 5). Another interesting fact is that the within-variety variation for some of these characteristics is smaller for imitators than for the innovator (Table 6). The price of underwriting, i.e., the underwriting spread, does not seem to differ significantly, although the within security sample mean of the underwriting fee for innovators is larger than for imitators (Table 7).

I will interpret this evidence as I present the econometric model and as I discuss the results of the econometric estimation. What I conclude from this evidence is that a useful model to describe competition between investment banks to underwrite corporate issues using this type of securities must be one of product differentiation in an oligopolistic industry. Differentiation occurs at the underwriters level, where innovators are distinguished from their imitators. Thus, from now on I will call a *variety* a distinct combination of a security and an underwriter.

3 The Model

3.1 Theory

The model I present below is built to illustrate the decision making process of firms that want to raise capital and have to choose an appropriate security and the best underwriter, that is, the investment bank or “book-manager” that will engineer the security and sell it. I will use a stylized model of firms' preferences and underwriters' information to find the demand for underwriting services by the different banks using their variety. The objective is to motivate a reduced form that can then be taken to the data and will allow us to test if those underwriters that invented the security have an advantage over the other underwriters that engineered the same security for their clients (the imitators). In particular, the model shows that firms will place a higher value to underwriting deals made with innovators than imitators.

It is worth to point out that the ultimate source of the innovator's advantage, the information asymmetry, is taken as given in this paper. The model that follows illustrates how the asymmetry is built into the demand function and what would be the empirical implications.[10]

3.1.1 The Setup

Firms that want to raise capital, the issuers, demand underwriting services from investment banks. These banks compete to underwrite the issue of a corporate security, and for this they offer differentiated products: debt or equity types of deals that offer investors different payoff schedules, horizons, call options, convertibility possibilities, etc. Thus, they compete for issuers that could use a non-standard variety of financial instruments. I formalize this setup below.

A firm that needs to issue a security to raise capital is indexed by $i \in \mathcal{I}$. At a given period, there is a set of varieties of instruments, $\mathcal{J} = \{1, 2, ..., J\}$ from which it can choose one. Let g be an index for groups of varieties, $g = 1, ..., G$, such that $G \leq J$ and let there be a partition $\mathcal{G} = \{\mathcal{J}_1, \mathcal{J}_2, ..., \mathcal{J}_G\}$ of $\mathcal{J}$ so that each set $\mathcal{J}_g$ contains those varieties which are closer to each other in terms of their characteristics. In this setup, for example, if consumers were choosing models and brands of a car then a set $\mathcal{J}_g$ would contain all brands of, say, Sport Utility Vehicles and some other set, $\mathcal{J}_h$, would contain all brands of compact models.

In our case, the groups in $\mathcal{G}$ are securities that have the same name, e.g., PERCS, LYONS or TOPRS and each variety would be determined by the name of the bank that underwrote the issue, e.g., PERCS by Morgan Stanley

[10] We can find some attempts in the literature to endogeneize the advantage of an innovator over its imitators. Herrera and Schroth (2000) provide a model that explains why innovators of derivatives acquire superior information over competitors. In a different perspective, Black and Silber (1986) derive an advantage to pionnering exchanges that establish liquidity early and Allen and Gale (1994, Chapter 4) show how first-movers can preempt imitation choosing their initial capacity as a Stackelberg leader.

or PERCS by Merrill Lynch.[11] Let b represent an underwriter in the set of banks, $\mathcal{B}$.

The firm chooses one security and one underwriter among those that offer that security. A variety $j \in \mathcal{J}$ is given by a unique (b, g) combination. Let u_{ij} be the value to firm i of choosing the variety, j. The setup for this decision is illustrated in Figure 8.

The utility function u_{ij} is central to this paper since it is the function whose parameters I will estimate using the data. I will characterize this function when I derive the preferences of issuers for underwriters that are innovators and underwriters that are imitators. The empirical literature that deals with the estimation of preference parameters in models of discrete choice uses special cases of the general specifications of linear preferences by Caplin and Nalebuff (1991) or Anderson et. al. (1989). In these studies, agents value a product according to a weighted sum of its components. These components, in general, are functions of the observable characteristics of the product. We shall see, below, how this structure is particularly appropriate for our study.

3.1.2 Preferences of Firms

In a typical underwriting deal of equity-linked or derivative corporate securities the firm will issue a security engineered by the underwriter. The firm has preferences over the set of possible structures for that security. I will define the underwriting deal as a combination of a vector of characteristics and an underwriting fee. Let $\boldsymbol{\theta} \in \Theta \subset \Re^m$ be this vector, and p the fee.

Definition 1 *An underwriting deal between a bank $b \in \mathcal{B}$ and a firm $i \in \mathcal{I}$ is fully characterized by $\{j, i, \boldsymbol{\theta}, p\}$.*

The vector of characteristics could include, for example, the premium over dividend paid by common stock, the date of maturity of the security, the number of periods this security is protected from a call option by the issuer, or, more broadly, discrete variables that determine whether the security is convertible or not, if it is convertible to common stock or debt, etc.

Let us start with a general random value function for the $i-$th firm in a given period, t. If a firm chooses some variety j its value depends on how

[11] Some securities can also be grouped into categories of similar intruments, i.e., what I referred to above as "families ". For example, SIRENS or ICONS are dividend paying convertible debt instruments, while ELKS or YEELDS are zero-coupon intruments with principal payment tied to the appreciation of a given stock portfolio. I do not deal with this prior level of classification in the theoretical model but we do account for proximity of securities between different groups in the econometric model.

the security has been engineered, i.e., on $\boldsymbol{\theta}_j$, and its "net income" after the fee is paid. Let this value function be denoted by

$$u_{ijt} = u(y_{it} - p_{jt}, \boldsymbol{\theta}_{jt}, \mathbf{q}_t, \epsilon_t) + \varepsilon_{ijt}. \tag{1}$$

Note that this value function has already been maximized with respect to other goods, that have prices $\mathbf{q}$.[12] As shown by McFadden (1981), this function is continuous in $y - p$ and $\boldsymbol{\theta}$ and twice continuously differentiable in the same arguments provided that the function is continuous and twice continuously differentiable in other goods and in $\boldsymbol{\theta}$.

ϵ_t is assumed to be an observable economy-wide shock that varies in time and changes the preferences temporarily. It can be thought of as, for example, a sudden urge for cash or a period of unusual underpricing of new issues. The term ε_{ijt} is assumed to be an additive random component that captures the random preferences of a given firm for a particular variety. It is unobservable to underwriters, and distributed independently with a continuously differentiable cumulative distribution function, $G(\varepsilon)$.

3.1.3 Underwriters

At each period underwriters engineer and price their own varieties of securities such that they maximize their profits. I assume that underwriters are Bertrand-Nash competitors in prices and $\boldsymbol{\theta}$. Their profits are given by

$$\pi_{jt} = p_{jt} q_{jt} - c(q_{jt}), \tag{2}$$

where the demand for the particular variety j is

$$q_{jt} = q(\mathbf{p}_t, \boldsymbol{\theta}_t, \epsilon_t) = M_t \int_{A_j(\mathbf{u})} dG(\boldsymbol{\varepsilon}), \tag{3}$$

and $c(.)$ is the total cost, such that $c'(.) \geq 0$. The demand for a particular variety is a function of the prices of all varieties the vector $\boldsymbol{\theta}$, and the observable economy-wide shocks. The set $A_j(\mathbf{u})$ is the set of all the possible realizations of these shocks, $(\varepsilon_{i1}, ..., \varepsilon_{iJ})$, such that $u_{ij} > u_{i_k}$, $k \neq j$, i.e., the set of all the states of nature that lead an issuer to a choice of variety j. M is a measure of the total number of firms, so that q_j is obtained by multiplying M by the share of firms that choose j of the total number of firms that want to raise capital.

[12] We will drop this argument for what remains of this paper to avoid unnecessary complications.

The next proposition will simplify our work significantly. It shows that an underwriter's choice of $\boldsymbol{\theta}_j$ that maximizes each firm's individual utility conditional on its available information also maximizes the underwriter's profits. I assume that $u(.)$ is twice continuously differentiable, strictly increasing and strictly concave.

Proposition 1 *For a given shock ϵ and a price p_j, if $\boldsymbol{\theta}_j^*$maximizes $u_{ijt}(y_i - p_j, \boldsymbol{\theta}_j, \epsilon_t, \varepsilon_{ij}, .)$ then $\boldsymbol{\theta}_j^*$maximizes π_j.*

I prove this proposition in the appendix, but the intuition is very simple. Since the unobservable component of utility is independent of the characteristics of the security and consumers taste shocks are independent, then the aggregate demand for a variety j is strictly increasing in the utility of any issuer. I have derived this result now because it allows me to eliminate $\boldsymbol{\theta}_j$ from the issuers' value function, by substituting the *optimal* choice of $\boldsymbol{\theta}_j$. The objective in the next section is to explain how that choice differs across underwriters with different information sets and, as a consequence, how the value of firms differs depending on the chosen underwriter.[13]

3.1.4 Asymmetric Information

The crucial feature that distinguishes an innovator from an imitator in this paper is that innovators exploit an informational asymmetry and are able to sign the largest share of firms using the security they invented while sustaining rents in equilibrium. In this paper I do not provide a model that explains why moving first gives the innovator an advantage, as Herrera and Schroth (2000) do. Instead, I take as given that innovators will possess an advantage over imitators and formalize it in this theory section to derive a the reduced form that will be taken to the data.

Let $\Theta_0 \in \Theta$ be the prior (common) knowledge set of all the possible characteristics that a security can have, and u_{ijt} the utility function in (1), which is also common knowledge to all underwriters at some point in time. To relate this abstraction to the case of equity-linked or derivative securities, imagine Θ_0 as a set of all possible engineering choices for a security before convertible debt was invented. Before the first innovation, debt securities would be zero coupon or would have paid a fixed or a floating rate, so any vector in Θ_0 would have zero entries for other characteristics yet to be used, e.g., for convertibility to common stock.

[13] The reader may have noticed already that this approach is equivalenet to the derivation of an indirect utility function.

If an underwriter spends resources on R&D to come up with a new security, it will discover new possible combinations of characteristics a firm may find valuable, possibly changing zero entries to add new dimensions to the structure of a security. The PERC, for example, was the first issue of preferred stock convertible to common stock with capped and floored appreciation. This new set of possible engineering choices must be tied to the discovery of firms's preferences for some previously non-existent feature of a security. In the case of the PERC, its innovator, Morgan Stanley, figured out that in the uncertain environment for investment in late 1991, an issue of a PERC would allow firms to attract investors with stable high yields, pricing the offer better than common stock while capping the security's appreciation potential (Pratt, 1991).

Definition 2 *An innovation is a new security g, tied to two private discoveries:*

(i) a set $\Theta_g \subset \Theta$ such that $\Theta_g - \Theta_0 \neq \{\phi\}$, and

(ii) a decomposition of unobservable preferences for a variety k of g

$$\varepsilon_{ik} = \nu(\boldsymbol{\theta}_k, \epsilon, .) + \widetilde{\varepsilon}_{ik}.$$

Based on this definition, after an investment bank invests on R&D it discovers some systematic component, $\nu(.)$, in the previously random term of any issuers' preferences, ε. This component depends on the engineering of the security, $\boldsymbol{\theta}$, and on a time-variant economy-wide shock,ϵ. This component of utility can also depend on new attributes of the $\boldsymbol{\theta}$ vector, i.e., it can be defined for newer features of a security, that previously had a zero entry (e.g., convertibility of preferred stock, stock portfolio-tied appreciation of principal, etc.). Thus, the innovator also enlarges its set of possible choices for $\boldsymbol{\theta}$.

Example 1 *The Equity-Linked Security or ELK was the first debt product to tie the repayment of principal to the stock price of another publicly traded company. Based on our definition:*

(i) the set of choices is now expanded with all the possible firms that can be chosen to tie their stock price to the repayment of principal, and

(ii) the discovered component $\nu(\boldsymbol{\theta}_k, \epsilon, .)$ would be a function of how issuers' cash flows are correlated with each firm whose stock price could be chosen to be tied to the repayment of principal.

When the first underwriting deal is made using a new security the innovator reveals a particular vector $\boldsymbol{\theta}$. The whole set of possible engineering choices for this particular security, Θ_g is kept private, though.

The goal now is to show that the optimal choices of $\boldsymbol{\theta}$ for innovators and imitators will differ, in general, and this will be reflected in the value function of a firm signing an underwriting deal with either. Proposition 1 allows me to eliminate the vector $\boldsymbol{\theta}$ of the said function and express the indirect utility as a function of the bank's identity. To see this, note that what distinguishes an innovator from an imitator is the set from which it can choose *any* $\boldsymbol{\theta}$. For the innovator, this set is $\Theta_0 \cup \Theta_g$, and for the imitator this set is $\Theta_0 \cup \boldsymbol{\theta}_k$. Let us summarize the identity of an investment banks by

$$b = \begin{cases} 1 & \text{if the underwriter is the innovator,} \\ 0 & \text{else,} \end{cases} \tag{4}$$

and let $v(y_i - p, b, \epsilon) \equiv \max_{\boldsymbol{\theta} \in \Theta^b} \quad u(y_i - p, \boldsymbol{\theta}, \epsilon)$.

Proposition 2 *For any couple of varieties j, l of the same security g, if j is issued by an innovator then $v_j(y_i - p, 1, \epsilon) \geq v_l(y_i - p, 0, \epsilon)$.*

The result is trivial. Θ_g^1 is the set of choices of the innovator and Θ_g^0 is the set of choices of the representative imitator. Since $\Theta_g^0 \subseteq \Theta_g^1$, the result follows.

The Proposition above has established that given prices and economy-wide shocks, innovators have an advantage over imitators. This advantage can be measured by the additional value to issuers if they were to choose an innovators' variety. Let this difference be named

$$\Delta v_j \equiv v(y_i - p, 1, \epsilon) - v(y_i - p, 0, \epsilon). \tag{5}$$

Note the importance of the time-variant shock. It provides the source of variation that makes the optimal choice of $\boldsymbol{\theta}$, for a given security, change. This is crucial, because otherwise the revelation of $\boldsymbol{\theta}$ in the first deal would suffice to make innovators and imitators identical in terms of their information. Note too that an underwriting deal can be defined simpler than in Definition 1. Now it can be summarized by $\{j, i, b, p\}$.

This result is convenient for the estimation because what I want to capture is exactly the difference in preferences for the different underwriters. Also, working with a value function, in which $\boldsymbol{\theta}$ has been eliminated, avoids losing a large proportion of observations for which the full $\boldsymbol{\theta}$ is not available. In other words, my interest is to distinguish preferences for these two types of banks more than to estimate the marginal valuation (and the derived elasticities) for a given characteristic of a security, e.g., years of call protection, yield advantage, etc.

Another reason is that preferences for the choices of each attribute in $\boldsymbol{\theta}$ may be complicated functions that make the estimation difficult. Thus, using a simpler function that summarizes all the attributes seems reasonable. This approach has been used by Caplin and Nalebuff (1991), who use a utility function that is linear in functions that map the dimensions of the product characteristics onto a different space. Using their own example, the benefits of a car could include only comfort and speed, but these could be more complicated functions of the physical attributes of the car.

3.1.5 Market Shares in Equilibrium

Here I discuss what Proposition 2 implies for the equilibrium in the market for underwriting. In this type of setup with differentiated products, there is a demand function for each variety. The next proposition establishes that, *ceteris paribus,* the demand for an innovator's variety of a given security is bigger than the demand for an imitator's variety of the same product.

Proposition 3 *Proposition 2 implies that for two varieties j, k of the same security g and for a fixed vector of underwriting spreads, $\mathbf{p} \in \Re_+^J$ such that $p_j = p_k$ then*

$$q_j(\mathbf{p}, .) \geq q_k(\mathbf{p}, .)$$

if j is the innovator's variety.

I prove this proposition in the appendix. Note that if $\Delta v_j > 0$ then the proposition above holds with a strict inequality.

I will not show formally that in equilibrium innovators have bigger within-securities market shares than imitators. In fact, it is not obvious that this will be the equilibrium outcome. It is true though that, under mild regularity conditions on $G(.)$ and $v(.)$, the game becomes one of strategic complementarity.[14] Moreover, if the best response function of the innovator "shifts right" if his advantage is positive, i.e., if $\Delta v > 0$, and if marginal costs are the same among underwriters then in equilibrium the innovator will charge a larger underwriting spread for his variety of the same security higher and

[14] Sufficient conditions for strategic complementarity would be that $\frac{\partial^2 q_i}{\partial p_j \partial p_k} > 0$ and $\frac{\partial q_i}{\partial p_k} > 0$. The latter condition is obvious just by inspecting the aggregate demand (see appendix). The former will be met if $v(.)$ is not too concave.

have a larger market share within that security. If this advantage eventually decreases, then the innovator's equilibrium price should decrease and converge to a symmetric equilibrium as the advantage goes to zero.[15]

3.2 The Econometric Model

I argued above that the market of underwriting new issues using equity-linked securities and other corporate derivatives may be well approached as one of differentiated products. Each variety offered is given by a combination of a security structure or name and the identity of an underwriter. In this section I present the model that I take to the data. This model will be a reduced form equation obtained from aggregating the individual firms' demands for the different varieties. I establish different sets of assumptions for the aggregation of individual firm demands, and the results will be different reduced forms to estimate: the multinomial logit and the nested logit demand models, each one requiring a different method of estimation.

3.2.1 The General Setup

I consider each time period $t = 1, ..., T$ a different market in which an issuer $i \in \mathcal{I}_t$ chooses its desired variety $j \in \mathcal{J}_t$. As the standard of the empirical literature of discrete models of demand, I will specify the value of this issuer as a function of observed and unobserved characteristics of the issuer and of the product offered by the underwriter, and of the relevant parameters. Let

$$u_{ijt} = \alpha(y_{it} - p_{jt}) + \mathbf{x}_{jt}\boldsymbol{\beta} + \xi_{jt} + \sum_k \sigma^k x_{jt}^k \nu_{it}^k + \varepsilon_{ijt}. \tag{6}$$

I assume that the value of net income is separable and linear. In other words, I am imposing that preferences are quasi-linear and as a consequence wealth effects are ruled out (α would be the (constant) marginal utility of income). This assumption is not only tractable and convenient for the estimation but quite reasonable for some types of products.[16] I believe this assumption is justified for this particular data set: the amount paid in underwriting fees is small relative to the value of the outstanding equity of

[15]The sufficient conditions for this would be that $\frac{\partial q_i}{\partial \Delta v} > 0$ and $\frac{\partial^2 q_i}{\partial q_j \partial \Delta v}$. Again, the former holds and it is verified just by inspecting the aggregate demand function. The latter condition is met only under certain assumptions about $G(.)$ and $v(.)$.

[16]Nevo (2000) argues that it is reasonable to assume quasi-linearity for ready-to-eat cereal because their price represents a small share of household expenditures. By the same token, it is not reasonable to make this assumption for the demand of cars. In fact, Berry, Levinsohn and Pakes (1995) use a Cobb-Douglas utility function, i.e., the additive term for net income is $\alpha \log(y_{it} - p_{jt})$.

issuers (the 95th percentile of the ratio of fees to equity is 0.02) or to their yearly earnings (the median proportion of fees of the yearly earnings is 0.06; the third quartile is 0.21).

The second term captures the indicators that distinguish an innovator from an imitator. The vector x_{jt} is then an index of Δv_j that will include all the variables that reflect differences in the information owned by underwriters. As we shall see below, I will not only employ dummy variables that capture the preference firms have, on average for investment banks with superior information. I will also try to identify the dynamics of this advantage by interacting the identity of banks with the number of time periods after the security has been imitated, and the order in which the security appears within its "family". I will also account for the fact that banks may acquire reputation as experienced underwriters of this type of securities based on their history as innovators within a family or any other type of equity-linked or derivative corporate security.

This approach differs from the existing empirical literature of discrete choice because the interest of most of the studies has been to estimate the elasticities of demand of the different characteristics of the goods (e.g. of sugar content, in the case of cereals, or miles per gallon, in the case of cars). Here the goal is to identify different preferences for innovators and imitators, not to identify the elasticities with respect to certain characteristics, so x_{jt} summarizes the engineering of the security in a set of characteristics of the underwriter.

Given the separability imposed above, the utility of choosing alternative j to raise capital can be decomposed into its mean, $\delta_{jt} = -\alpha p_{jt} + \mathbf{x}_{jt}\boldsymbol{\beta} + \xi_{jt}$ and a deviation from it, $\mu_{ijt} = \alpha y_{it} + \sum_k \sigma^k x_{jt}^k \nu_{it}^k + \varepsilon_{ijt}$. The unobservable (to the econometrician) characteristics of the security j itself are captured by ξ_j, while the deviation term is used to account for the heterogeneity of firms preferences. The individual preference shocks, ν_{it}^k interact with every characteristic of the security to obtain different marginal utilities for attributes across firms. In other words, the marginal utility of the k-th characteristic is given by

$$\frac{\partial u_{ij}}{\partial x_j^k} = \beta^k + \sigma^k \nu_i^k, \tag{7}$$

and depends on the firm level preference shock.

ε_{ijt} would be a purely idiosyncratic, mean zero, shock. Below I will explain briefly the different ways I will estimate the parameters of the value function.

3.2.2 Logit Demand

Berry (1994) shows that if we make some assumptions about the unobserved components and distributional assumptions about ε_{ijt} we can identify the parameters of a simplified version of (6) using the observed market shares of all varieties, j. Note that the market share is the proportion of firms that choose security j of the total number of firms that make a new corporate issue.

Assuming that $\sum_k \sigma^k x_{jt}^k \nu_{it}^k$ is zero for every variety, i.e., no random coefficients, and that ε_{ijt} has a density function $f(\varepsilon) = \exp(-\exp(-\varepsilon))$ the market shares predicted by the model, $\widehat{s}_{jt}$, which are obtained by integrating all the realizations of unobservables that lead to a choice of j over all other varieties, will be given by the well-known closed form solution (the logit formula):

$$\widehat{s}_{jt}(\boldsymbol{\delta}_t) = \frac{e^{\delta_{jt}}}{1 + \sum_{l=1}^{J} e^{\delta_{lt}}}. \tag{8}$$

Note that the average utility of the outside alternative is normalized to zero ($\delta_{0t} = 0$) and that the term αy_{it} drops out because it is common to all the choices. The logit formula has the property that the market shares are uniquely pinned down by the average utility of a choice j. Thus, α and $\boldsymbol{\beta}$ can be obtained from a regression of the difference of the logarithms of the observed market share of j and an outside alternative, on $\mathbf{x}_{jt}$ and p_{jt}, e.g.:

$$\ln s_{jt} - \ln s_{0t} = -\alpha p_{jt} + \mathbf{x}_{jt}\boldsymbol{\beta} + \xi_{jt}. \tag{9}$$

The estimation of this model is simple. The challenge is to find appropriate instruments for the price because it is very likely that it is correlated with the unobservables, ξ_{jt}. This is a typical problem found in studies that use product characteristics as regressors. In this case, $\mathbf{x}_{jt}$ uses issuers' characteristics that summarize the full description of the product, so it is less likely that ξ_{jt} contains product unobservables correlated with the price.

There may still be other costs of imposing this particularly convenient structure. As a consequence of assuming that the ε_{ijt} are independent and homoskedastic, the odds ratios of choosing one variety over another do not depend on the value of *other* varieties. This can be problematic: suppose the demand for MIPS were evenly split between Goldman, Sachs and Merrill Lynch, and each were half the demand for Salomon Brother's ELKS. This model would predict that the ratio of the market share of Goldman's MIPS to Salomon's ELKS would still be one half, even if Merrill increases its underwriting fee by any magnitude. Implicitly, the business lost by Merrill Lynch would be absorbed by both Goldman and Salomon so as to preserve the ratio, never mind that Morgan Stanley and Merrill Lynch offer close varieties and Salomon offers a different product.

3.2.3 Nested Logit

The nested logit allows a richer pattern of substitution than the simple logit and at a small additional computational cost. The decision to choose a variety is now represented by a tree as in Figure 8. The preferences of firms are allowed to be correlated within groups. In this case, different varieties of the same securities offered by different investment banks would be closer substitutes of each other than any other security.

In this case, the utility of a given choice, j, can be modelled as a restricted version of (6), allowing for random coefficients, ζ_{ig}, on security specific dummies. Thus, we have

$$u_{ijt} = \delta_{jt} + \sum_g d_{jg}\zeta_{ig} + (1-\sigma)\varepsilon_{ijt}, \tag{10}$$

where $d_{jg} = 1$ if $j \in \mathcal{J}_g$, and ε_{ijt} is still assumed to be independently and identically drawn from a Weibull distribution.

If the random coefficients are also assumed to be drawn from a Weibull distribution, then so is the term $\zeta + (1-\sigma)\varepsilon$. The degree of within group correlation is given by σ : if it approaches one then so does the within security correlation of utility levels, and if it approaches zero then there is no within security correlation and we are back to the logit model. Due to this assumption there is an analytical solution for the predicted market shares of underwriters within the security:

$$\widehat{s}_{j/gt}(\boldsymbol{\delta}_t, \sigma) = \frac{e^{\delta_{jt}/1-\sigma}}{D_{gt}}, \tag{11}$$

$$D_{gt} = \sum_{h\in\mathcal{J}_g} e^{\delta_{ht}/1-\sigma}. \tag{12}$$

The overall market share is

$$\widehat{s}_{jt}(\boldsymbol{\delta}_t, \sigma) = \frac{e^{\delta_{jt}/1-\sigma}}{D_{gt}^{\sigma}[\sum_{f\in\mathcal{G}} D_{ft}^{1-\sigma}]}. \tag{13}$$

Normalizing $\delta_0 = 0$, which implies $D_0 = 1$ then $\alpha, \boldsymbol{\beta}$ and σ can be recovered from an Instrumental Variables regression of the difference of the logs of the observed market share of j and the outside alternative on x_{jt}, p_{jt} and $s_{j/gt}$ because

$$\ln s_{jt} - \ln s_{0t} = \sigma \ln s_{j/gt} - \alpha p_{jt} + \mathbf{x}_{jt}\boldsymbol{\beta} + \xi_{jt}. \tag{14}$$

Again, instruments for prices and additional instruments for within security market shares must be used to obtain consistent estimates because both variables are endogenous.[17]

As I mentioned, this variation of the random indirect utility will allow more reasonable substitution patterns. Let us inspect the price elasticities of this model. For two varieties, j and l, the price elasticities $\frac{\partial s_j p_l}{\partial p_l s_j}$ would be given by:

$$\eta_{jl} = \begin{cases} -\alpha p_j \{\frac{1}{1-\sigma} - s_j[1 + \frac{\sigma}{1-\sigma} D_g^{1-\sigma} \sum_{f \in \mathcal{G}} D_f^{1-\sigma}]\} & \text{for } j = l \in \mathcal{J}_g, \\ \alpha p_l s_l \{1 + \frac{\sigma}{1-\sigma} D_g^{1-\sigma} \sum_{f \in \mathcal{G}} D_f^{1-\sigma} & \text{for } j \neq l, \text{ and } j, l \in \mathcal{J}_g, \\ \alpha p_l s_l & \text{otherwise.} \end{cases} \tag{15}$$

Cross-price elasticities for two different varieties within the same group will be different than cross-price elasticities for varieties across different groups, even if they have the same prices and market shares (provided that $\sigma > 0$). Still, the cross-price elasticity of one variety with varieties of other groups will be identical, even if one variety belongs to a group that is closer to the other in terms of the uses of the security.

3.2.4 Issuer Heterogeneity

The two models above deal only with mean utility levels, δ, and assume away the individual preference shocks. This imposed some undesirable restrictions on the substitution patterns. To deal with this, I use data from COMPUSTAT about all the firms that did new issues using equity-linked security in the sample. This will introduce issuer heterogeneity that will relax the restrictions on cross-price elasticities in (15).

In this case, I consider a vector of f firm characteristics $\mathbf{v}_i$, each one to be interacted with the price to obtain the following estimable relationship:

$$\ln s_{jt} - \ln s_{0t} = -\alpha p_{jt} + \mathbf{x}_{jt}\boldsymbol{\beta} + p_{jt} \sum_f \sigma^f \nu_{it}^f + \xi_{jt.} \tag{16}$$

As we shall see in the results, the cost is that we will lose a significant proportion of the observations in the sample. Many of the issuers of equity-linked securities had no record in COMPUSTAT.

[17] See Berry (1994) for a proof.

3.3 The Data

As I mentioned before, the SDC Database of New Issues records all the public and some private offerings made since 1962. For securities defined in SDC as equity-linked or derivative corporate securities there are 662 offerings up to March 2001 (the first issue, a LYON, was made in April of 1985). There are 50 securities and a total of 98 varieties. I compute the varieties' market shares over the whole market of new issues and over the varieties within the security at different time periods.

I divide the whole sample in time periods rather than aggregate the data by varieties over the whole time span studied. Overall aggregation would reduce significantly the number of observations (to 98) and would also eliminate the time variation of market shares and underwriting fees, compromising seriously the consistency of the estimators. Thus, I treat each time period as an independent market, so that there is a demand function for each variety at each time. The parameters of this function are identified by cross-sectional variation in prices, in the identity of the underwriter, and the issuer's characteristics and by the time variation in prices and issuer "experience". The panel structure of the data is crucial since I want to study the dynamics of the advantage to innovators.

To form the panel I must choose the length of each time period, though. The shorter the length of each period increases the size of the usable data set but increases the risk of aggregating very few or unique deals per period, which would increase dramatically the variation in the market shares. To avoid arbitrariness in the choice of the length I do the estimations at four different levels of aggregation: using 16 periods (annually), 8 periods (biannually), 11 periods (18 months) and 12 periods (16 months). In this way we can also have an assessment of the robustness of the results to this choice.

The panel is unbalanced because not all securities are offered at each period. Only two varieties are offered in the first period and 98 in the last. I consider standard equity as the outside option to issuers, i.e., standard equity is the variety $j = 0$. I approximate the total size of the market for new issues using

$$M = q_0 + q_1 + ... + q_J. \tag{17}$$

The unit of demand is number of deals, not dollars underwritten. This assumes that firms set ex-ante the amount of cash they want to raise in the offer, and the choice I model here is the choice of the security and the underwriter.

3.3.1 Variables

Market Shares Overall market shares, s_j, are the observed aggregate number of deals for that variety in a given period divided by the total number of new issues. Within-security market shares divide the number of deals by the total number of issues using the relevant security:[18]

$$\begin{aligned} s_{jt} &= \frac{q_{jt}}{M_t}, \\ s_{j/gt} &= \frac{q_{jt}}{\sum_{l \in \mathcal{J}_g} q_{lt}}. \end{aligned}$$

Prices Prices of underwriting are the fees charged by the investment bank that leads the syndicate of book managers of an offer. They are expressed as a percentage of the principal underwritten and called underwriting spreads. Usually this spread can be disaggregated in the underwriting fees and management fees. This disaggregation is seldom observable though, so the price variable I will use is the total spread.[19]

Demand Shifters in $\mathbf{x}_{jt}$ The demand shifters that do not exactly indicate the information asymmetry between underwriters are variables about the underwriter's experience and reputation issuing this type of securities. I use the total number of innovations in equity-linked products and innovations within the particular family of the security accumulated by the underwriter. I use time period dummies to control for observable economy-wide shocks and group dummy variables.

Advantage to Innovators One way to test if innovators have advantages on the revenue side is by including a dummy variable that equals one when

[18] In some periods, market shares of existing varieties are zero. The computation of logit and nested logit models requires taking the logarithm if these shares. To avoid the indeterminacy problem I use a transformation s_j that does not alter its distribution significantly. I compute instead

$$\begin{aligned} \ln s^*_{jt} &= \ln(s_{jt} + 0.00001), \\ \ln s^*_{j/g} &= \ln(s_{j/gt} + 0.00001). \end{aligned}$$

Excluding these observations would not only bias the sample selection but also imply a loss of 191 observations that actually reveal that the demand was zero.

[19] For periods of zero market shares no information of the bids made by potential underwirters is observed. Since these varieties were available to firms, although none chose to use them, we assume there is a going price for them. We approximate this price with the last observed price for that variety.

the underwriter was the first to issue that security. A positive estimate of the coefficient of this variable would imply that, on average, firms have stronger preferences for innovators.

In the model presented above, the innovator has an advantage because it holds private information about the security issued. However, this advantage could diminish as more deals are completed by imitators. Thus, we would expect the estimate of the coefficient of the innovator dummy interacted with the number of deals after the security was imitated to be negative. Moreover, if the security is a late generation of a given group, more information about this type of securities would have been aggregated, and we would expect imitators to learn the innovators private information faster. Thus, I also interact this dummy with the generation number to get a richer characterization of the dynamics of learning by doing.

Formally, I model these dynamics by specifying the component Δv_j of the firms utility as:

$$\Delta v_{jt} = \gamma_0 i_j + \gamma_1 i_j * gen_j + \gamma_2 i_j * gen_j * \widetilde{t}, \tag{18}$$

where the dummy variable $i_j = 1$ if the variety j is the innovator's variety, gen is the generation number of the security and $\widetilde{t}$ the number of time periods since the first imitation.

Issuers Data I use financial data from COMPUSTAT's quarterly database that matches the period of the offer. I use the total market capitalization to measure the size of the firm. I also use indicators of common equity, preferred equity, short term, long term debt and subordinated debt all expressed as percentages of capitalization.

3.3.2 Instruments

Since it is very likely that the price is endogenous, instruments are needed to obtain consistent estimates of the parameters of the model. In the case of the nested logit specification, the within-securities market shares are used as a regressor and these are possibly endogenous too. To choose appropriate instruments I follow the suggestions of Berry, Levinsohn and Pakes (1995) and Berry(1994). Instruments for the underwriting spread (price) include the averages of characteristics of the security over the *competing* varieties, like years of call protection, years prior to call at par, percentage yield, which should not be correlated with the error term since the advantage term summarizes all characteristics of the security. By the same token instruments for the within-security market shares include characteristics of *other* underwriters in the same group (e.g., total and within family accumulated innovations by the other underwriters of the same security). To test if these instruments over-identify the parameters of the models I perform a Hausman test of over-identifying restrictions.

4 Results

4.1 Logit Demand

To serve as a benchmark, first, I fit the simplest, yet most restrictive, demand model: the multinomial logit. I only report here the results for the aggregation at 12 time periods for the sake of parsimony (the subsequent estimations will include all aggregation levels to show the robustness of the results). Table 8 reports the estimates of the parameters of (9), allowing for unobservable (to the econometrician) attributes in the different varieties and using an instrumental variables method to account for the correlation between the price and the unobservables (the standard errors were estimated using the Huber/White variance estimators, allowing for heteroskedasticity and serial correlation within securities). I fit two models: one that only includes the innovator indicator from equation (18) (reported in the "Average Advantage" column) and another one that specifies the full dynamics in (18). I use time period-specific dummies and fixed effects for the security group.

We can see, for both columns, that most estimates have the expected sign. The average value to an issuer increases if the number of innovations in equity-linked securities accumulated by its chosen underwriter increases. The negative sign of the number of accumulated innovations within that security's group, though, is an unexpected anomaly.

The underwriter's fee (the price) is significant at the 90% level. Note that I report the estimated α (with positive sign) to be consistent with our notation above, where the price component of utility appears as $-\alpha p$. In consistency with oligopolistic behavior, this estimate must produce price-inelastic demands. In Table 9 I report the number of demands (of 323) that violate this condition. Both logit models imply 50 and 49 inelastic demands, respectively, out of 323 estimates. The average elasticity, though, is well above 1.

In both columns, the innovator dummy has a positive coefficient, significant to the 99% level of confidence, suggesting stronger preferences for the innovator's variety, *ceteris paribus*. The second column reveals an interesting result. The coefficients on the innovator dummy, on the dummy interacted with the generation number, and on the dummy interacted with the generation number and the time after imitation are all significant to the 99%

level of confidence. The estimate of the coefficient of the first interaction term, $i * gen$, is positive, revealing that the later the generation, the higher the average *initial* advantage of the innovator. The second interaction term, $i * gen * \widetilde{t}$, has a negative estimated coefficient, showing that this advantage decreases in the number of periods that imitators have been in the market, and that this advantage diminishes *faster* the later the generation.

The previous results assumed that varieties of the same security were as close to each other in the product space as varieties of different securities. Group dummies may have accounted for proximity within the family, but not within the security. The results that follow are for the nested logit model, that deals with this problem.

4.2 Nested Logit Demand

The estimation procedure for the nested logit demand model is similar to the one used for the multinomial logit. The difference is that, here, I include as a regressor the within-security market shares for each variety in order to obtain an estimate of the intra-security substitution effect. For this matter, additional instruments must be used since the new regressor is believed to be correlated with the variety's unobservable characteristics. This model was fitted for the four different aggregations of data: 8,11,12, and 16 periods. The results are shown in Table 10.

The estimated coefficient of price still has the correct sign for all the aggregations. It is significant at least at the 95% level but for the case where $t = 8$ (where its p-value is 0.115). The estimated elasticities increases sharply after accounting for the proximity of varieties, and as a consequence the implied number of inelastic demands is much smaller (10 at most).

The estimated coefficient for the substitution parameter is significant in all cases, and the estimate is within the appropriate bounds, 0 and 1 ($0.615 < \widehat{\sigma} < 0.729$). This result is consistent with the theoretical setup in which varieties within a security type are closer substitutes than varieties outside the security type: issuers switch bankers before using a different security structure.

For all these cases I have fitted the model that describes the dynamics of the innovator's advantage. The estimates of the innovator's advantage component reveal the same dynamic pattern as before: the innovator dummy has a positive estimated coefficient, as well as the dummy interacted with the generation number. The coefficient of the interactions of the innovator dummy with the generation number and the number of periods after the first imitation is negative.

Figures 9 to 12 illustrate better what the estimates for the dynamics of the advantage mean in terms of the time during which issuers value innovator's varieties more than imitators'. I plot the estimated advantage of the innovator, i.e., the predicted ratio of the innovator's market share to the imitator's ($\frac{s_{In}}{s_{Im}}$), in the vertical axis against time, measured in years, in the horizontal axis. We can see that, for all aggregations, the innovator of a first generation security has the smallest initial advantage over his imitators. In all cases, this advantage disappears slowly (in 12 years, on average). In sharp contrast, an innovator of, say, a seventh generation security enjoys a bigger average initial advantage over other competing underwriters. This advantage, though, will be gone shortly after the product's second year of having been imitated (that happens when both market shares are predicted to be equal to each other). One possible interpretation of this result is that late generations are often very complicated modifications of existing securities. At first it is difficult for imitators to learn how innovators are engineering the deals, but in time they should learn faster given that more information has been aggregated about the security type or of the family of securities.

Since I estimate this model using instrumental variables, I test if the restrictions imposed by using the chosen instruments over-identify the parameters of the model (the F-statistic for the test and its p-value are also reported in Table 10). The hypothesis that the model is over-identified is rejected in all aggregations but the last one, when the sample is split in 8 periods. Rejection may be due to the fact that the instruments chosen do not introduce sufficient independent variation themselves to account for the variation in all the endogenous variables of the model (price and within-type market shares). It is also possible that the model is not fully specified and the instruments themselves are correlated with other excluded exogenous variables. However, it is interesting that the model seems to be over-identified when each observation is the result of aggregating over 2 years and not less (when $t = 8$). Thus, it is possible that within shorter intervals, the instruments used are strongly correlated between themselves, while this may not be the case for longer periods. It is also worth pointing out that, the rejection of over-identification at some levels of aggregation is not strong evidence against our choice of instruments, since the results are consistent over all the aggregations (the over-identified models and those that are seemingly not).

4.3 Issuers Heterogeneity

The estimation by instrumental variables of the logit and nested logit demand models above may have allowed us to obtain consistent estimates of the own-price elasticity, but it may still yield implausible cross-price elasticities for varieties in different groups. Also, the test of over-identifying restrictions for the nested logit specification revealed that the model may still have not been completely specified. Below (Table 11), I show the results after adding the characteristics of the issuer to the model via interactions with the price variable. Although it is not my goal to estimate these cross-price elasticities, adding heterogeneity will differentiate own-price elasticities by the type of firms.

Although I lose observations when using issuers' data, Table 11 shows results that do not differ qualitatively to the previous ones. The same dynamic behavior of the innovators advantage is observed in all four cases. For all aggregations over time, the initial advantage is bigger than in the previous specification but it also decreases at a much faster rate. On average, for all cases of the model with interactions, the advantage of each generation would be gone almost by the time predicted in the nested logit model without interactions (see Figure 13 for the case when $t = 8$).

Of the five issuers variables that I interact with price, only market capitalization and preferred stock as a percentage of market cap were found to be significant at a level higher than 90%. Their estimated coefficients were both positive. One possible explanation is that market capitalization is an approximation for the available sources of finance to the issuer. Similarly, since most of the varieties are forms of preferred stock or convertible to preferred stock, firms with a larger proportion of this type of stock have more available instruments to raise capital and thus their demands are more elastic to underwriting spreads.

Even though estimates of the elasticity of demand are much higher, the number of inelastic demands increases relative to the total number of usable data points, most likely due to the large variation in the issuers characteristics.

Although I added more regressors to the model, this did not change substantially the result for the tests of over-identifying restrictions. We still cannot reject that the model is over-identified in the case where $t = 8$. Now, however, we obtain a similar result when the time periods are shortest ($t = 16$). As before, although the model does not seem to be over-identified in all the cases, the estimates are consistent over all the estimations: the implied elasticities for each specification and the implied speeds at which the innovator's advantage diminishes do not differ significantly across the different time aggregations.

5 Summary

This paper has provided new evidence of the sources of first-mover advantages in innovations in finance. The existing empirical literature of financial innovation identified the following stylized fact: that investment banks are able to profit from innovation despite being imitated almost immediately. Whatever advantage they had over competitors, the clue to the profitability of unpatentable innovation in finance was that innovators were able to underwrite the largest market shares of corporate initial offerings.

This paper has tried to provide an answer to the question of what is the source of the advantage. For this purpose I used data of all the New Issues using Equity-Linked and derivative corporate securities. This paper has tested empirically the hypothesis that firms have stronger preferences for underwriters that are innovators, not imitators. The theoretical motivation for this conjecture was the following: firms that need to raise capital have to use a security which is engineered by investment banks that act as underwriters. If the underwriter is the innovator of the security, this signals he is better informed about the choices that will be best for the firm. On average, the value to the firm from doing the issue with the innovator will be larger.

To find an appropriate method to test this hypothesis I started by analyzing preliminary evidence that suggested that innovations in corporate products such as equity-linked securities are frequently improvements or generations of previous designs, so that families of securities could be identified. I also noted that banks offered differentiated underwriting services. Thus, I used the discrete choice theory of product differentiation as the framework to model the decisions of firms to choose security structures and underwriters. The evidence also suggested that innovators had advantages that presumably dissipated over time. Thus, I decided not only to study the overall advantage of innovators, but its dynamics.

For that purpose I specified the value to a firm for choosing a particular security and a particular underwriter whose parameters were estimable. I claimed that the advantage that the innovator had over its competitors in the market to underwrite new issues can be summarized in an index that included his identity, the time elapsed after the innovator was imitated, and the generation of a security. Moreover, this index appeared directly in the value function of a firm because banks make different engineering choices contingent on their private information.

Using data of all the new issues of corporate securities from the Securities Data Company Database I estimated the parameters of the dynamics of the innovators' advantage for multinomial logit and nested logit demand models. I also used financial data from COMPUSTAT about the firms that issued the securities in the sample to enrich the specification. A result consistent to all the specifications was that preferences for innovators are, on average, stronger than for imitators. Interestingly, these preferences were initially stronger the later generation of an innovation, possibly reflecting the fact that late generations get more complex and are therefore harder to understand to imitators. The preference for an innovator over an imitator diminishes in time, possibly as a result of imitators catching up with innovators. Further, the speed of the reduction in the preference for innovators over imitators was larger for later generations. I interpreted this as the fact that late generations appear naturally when more information has been aggregated about the family of securities they belong to, making learning about the innovator's private information easier.

The scope of the paper has been limited by the availability of data. Cost data was unavailable for most of the observations, making it unworthy to estimate the model jointly with a pricing equation. This would have also allowed to test if innovators and imitators have different marginal costs for underwriting offers, another potential source of first-mover advantages.

This paper has also taken innovation as exogenous. The set of choices available to firms was taken as given at each time. Certainly, one interesting way to continue this line of research would be to identify the preferences of firms for new securities at each time they make their choices. If the choices of the firm were to choose a security of a set of already existing securities or to rather choose to be the first issuer of a new security, then the data in each deal could reveal what determines when an innovation is to be introduced.

APPENDIX

Proof of Proposition 1. The value of choosing variety j is $u(\boldsymbol{\theta}_j, .)+\varepsilon_{ij}$. Thus, given the properties of $u(.)$, if $\boldsymbol{\theta}_j^*$ maximizes u_{ijt} then it must be that

$$\forall m \quad \frac{\partial u(.)}{\partial \theta_j^m}|_{\boldsymbol{\theta}_j^*} = u_m(\boldsymbol{\theta}_j^*, .) = 0, \tag{19}$$

where θ_j^m corresponds to each entry of the $\boldsymbol{\theta}_j$ vector.

To find the profit maximizing choices, let us first solve for the demand function for some variety j, as given in (3). Note first that the probability that an arbitrary issuer chooses variety j over any other variety k is

$$\begin{aligned} \Pr(u_{ij} &\geq u_{ik}) = \Pr(\varepsilon_{ik} \leq u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon_{ij}) \\ &= G(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon_{ij}). \end{aligned}$$

Further, since each ε_{ik} is drawn independently from $G(.)$, the probability that j is the chosen variety for i is

$$\prod_{k \neq j} G(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon_{ij}),$$

and the aggregate demand for this variety is just

$$q_j(\boldsymbol{\theta}_j, .) = M \int_{\varepsilon} \prod_{k \neq j} G(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon') dG(\varepsilon').$$

A profit maximizing choice of $\widetilde{\boldsymbol{\theta}}_j$ would solve the set of first-order conditions

$$\forall m \quad \frac{\partial \pi_j}{\partial \theta_j^m}|_{\widetilde{\boldsymbol{\theta}}_j} = 0.$$

Note that any of these first-order conditions have the form:

$$\frac{\partial \pi_j}{\partial \theta_j^m} = p_j \frac{\partial q_j(\boldsymbol{\theta}_j, .)}{\partial \theta_j^m} - c'(q_j(\boldsymbol{\theta}_j, .)) \frac{\partial q_j(\boldsymbol{\theta}_j, .)}{\partial \theta_j^m},$$

where

$$\frac{\partial q_j(\boldsymbol{\theta}_j, .)}{\partial \theta_j^m} = M \int_{\varepsilon} u_m(\boldsymbol{\theta}_j) \{ \sum_{k \neq j} \frac{G'(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon')}{G(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon')} \} \prod_{k \neq j} G(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon') dG(\varepsilon').$$

Thus, since $\frac{\partial \pi_j}{\partial \theta_j^m} = \{p_j - c'(q_j(\boldsymbol{\theta}_j, .))\}\frac{\partial q_j(\boldsymbol{\theta}_j,.)}{\partial \theta_j^m}$ and $p - c' > 0$, it must be that $\frac{\partial q_j(\boldsymbol{\theta}_j,.)}{\partial \theta_j^m} = 0$ if each θ_j^m is a maximizer. Moreover,

$$\frac{\partial q_j(\boldsymbol{\theta}_j, .)}{\partial \theta_j^m} = M u_m(\boldsymbol{\theta}_j) \int_\varepsilon u_m(\boldsymbol{\theta}_j)\{\sum_{k \neq j} \frac{G'(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon')}{G(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon')}\} \prod_{k \neq j} G(u(\boldsymbol{\theta}_j) - u(\boldsymbol{\theta}_k) + \varepsilon') dG(\varepsilon')$$

where $G'(.) > 0, G(.) > 0$ so the integral above is strictly positive. $\frac{\partial q_j(\boldsymbol{\theta}_j,.)}{\partial \theta_j^m} = 0$ is only satisfied when $u_m(\boldsymbol{\theta}_j) = 0$ $\forall m$ and that is only when $\boldsymbol{\theta}_j = \boldsymbol{\theta}_j^*$. ■

Proof of Proposition 3. Let j and k, l be varieties of the same security g, and q an arbitrary variety of another arbitrary security. By Proposition 2

$$\begin{aligned} v_j(y-p,1,.) &\geq v_k(y-p,0,.), \\ v_j(y-p,1,.) &\geq v_l(y-p,0,.). \end{aligned}$$

The aggregate demand for the innovator's variety, given than varieties of the same security are priced symmetrically is

$$\begin{aligned} q_j(\mathbf{p}, .) &= \int_\varepsilon G(\Delta v_g + \varepsilon') \prod_{l \neq k, l \in \mathcal{J}_g} G(v(y-p,1,.) - v(y-p_l,0,.) + \varepsilon') \\ &\quad * \prod_{q \neq j, q \notin \mathcal{J}_g} G(v(y-p,1,.) - v(y-p_q,b,.) + \varepsilon') dG(\varepsilon'). \end{aligned}$$

For the imitators' varieties, the demand is

$$\begin{aligned} q_k(\mathbf{p}, .) &= \int_\varepsilon G(-\Delta v_g + \varepsilon') \prod_{l \neq k, l \in \mathcal{J}_g} G(v(y-p,0,.) - v(y-p_l,0,.) + \varepsilon') \\ &\quad * \prod_{q \neq k, q \notin \mathcal{J}_g} G(v(y-p,0,.) - v(y-p_q,b,.) + \varepsilon') dG(\varepsilon'). \end{aligned}$$

Clearly, since $G(.)$ is a strictly increasing function, by Proposition 2

$$\begin{aligned} G(\Delta v_g + \varepsilon') &\geq G(-\Delta v_g + \varepsilon'); \\ G(v(y-p,1,.) - v(y-p_l,0,.) + \varepsilon') &\geq \\ &\quad G(v(y-p,0,.) - v(y-p_l,0,.) + \varepsilon'), \\ \text{and } G(v(y-p,1,.) - v(y-p_q,b,.) + \varepsilon') &\geq \\ &\quad G(v(y-p,0,.) - v(y-p_q,b,.) + \varepsilon'). \end{aligned}$$

and thus

$$q_j(\mathbf{p}, .) \geq q_k(\mathbf{p}, .).$$

Note that if $\Delta v_g > 0$, then $q_j(\mathbf{p}, .) > q_k(\mathbf{p}, .)$. ■

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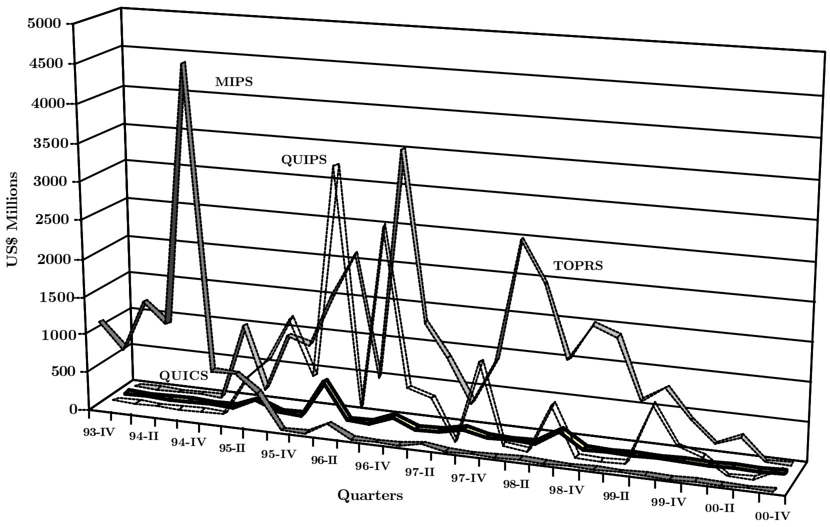

Figure 1: Principal Underwritten Using Tax-Deductible Preferred Products

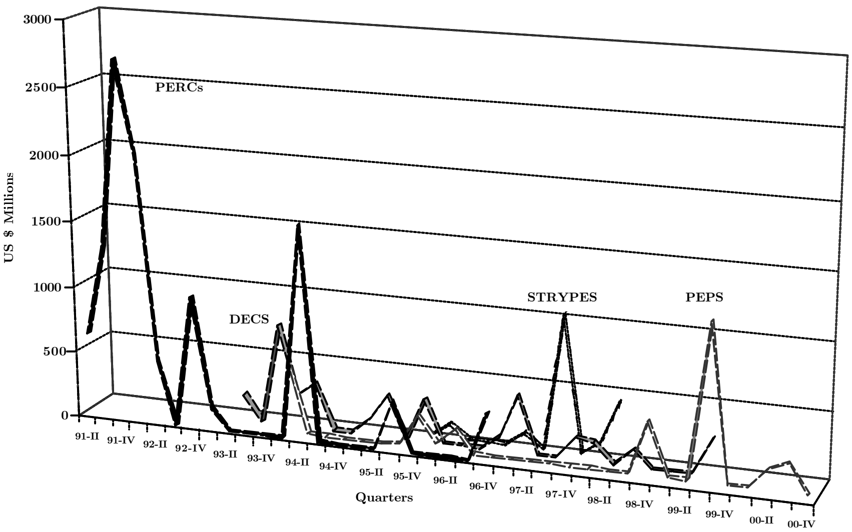

Figure 2: Principal Underwritten Using Convertible Preferred Products

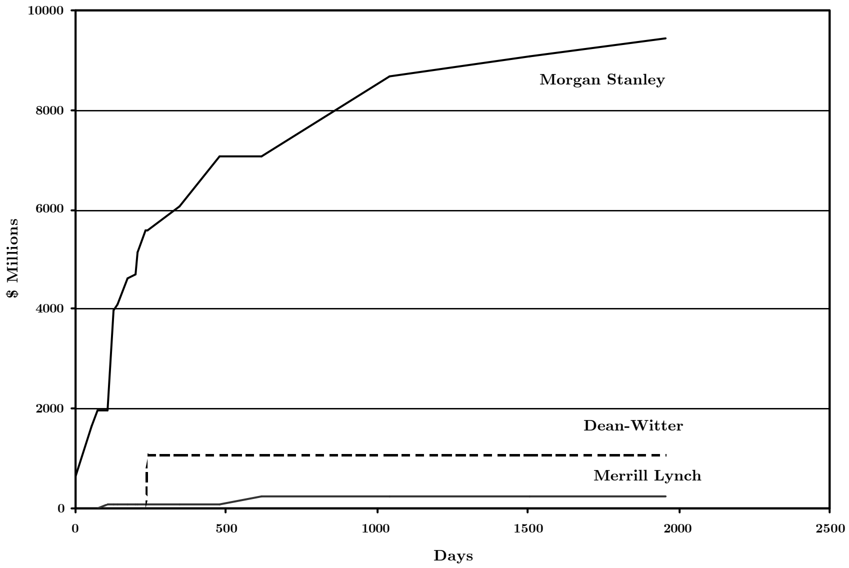

Figure 3: Cumulative Principal Underwritten, by banks, using PERCS (1st generation)

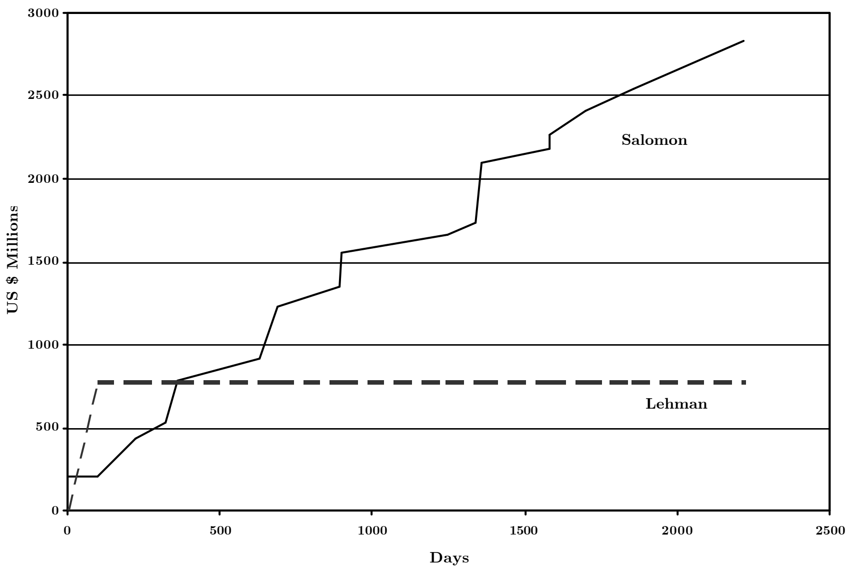

Figure 4: Cumulative Principal Underwritten, by banks, using DECS (3rd generation)

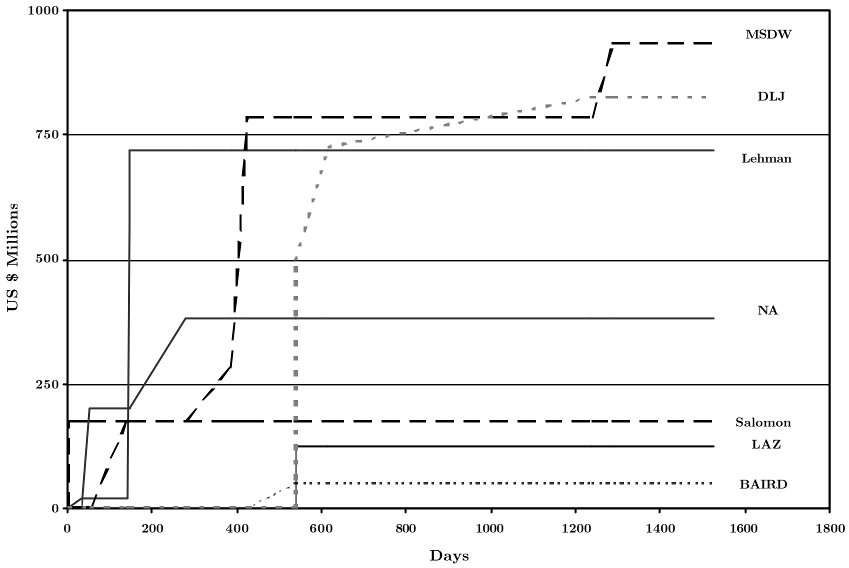

Figure 5: Cumulative Principal Underwritten, by banks, using Trust-Originated Convertible Preferreds (14th generation)

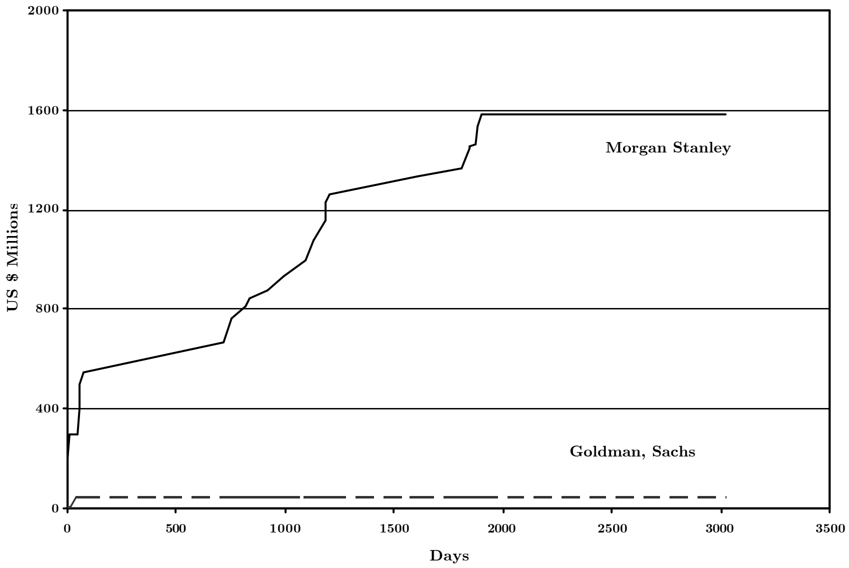

Figure 6: Cumulative Principal Underwritten, by banks, using PERLS (1st generation)

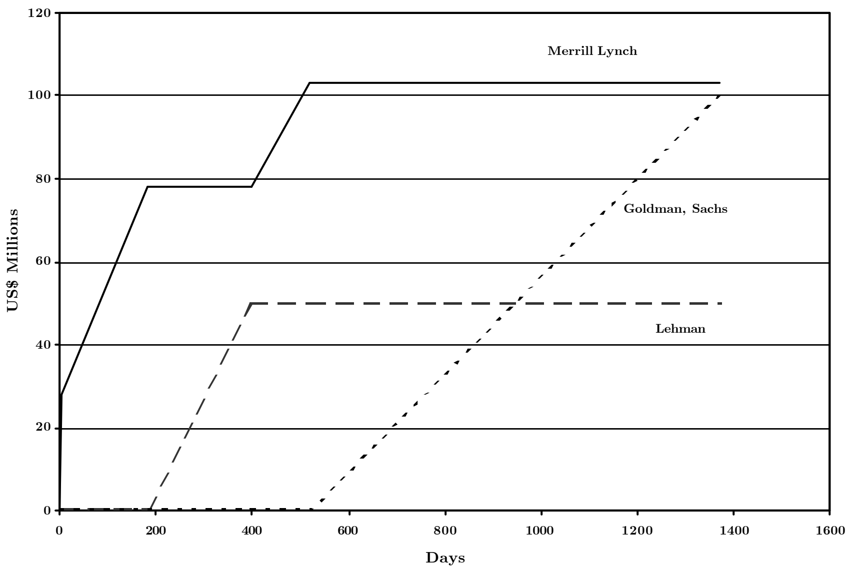

Figure 7: Cumulative Principal Underwritten, by banks, using SMART Notes (4th generation)

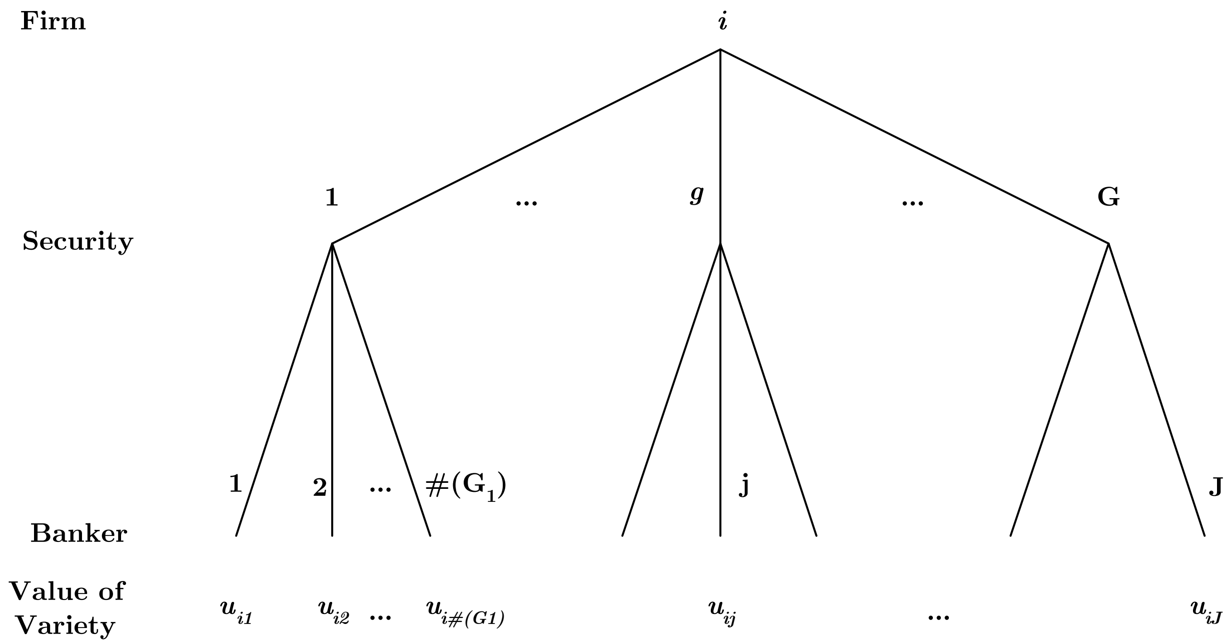

Figure 8: The decision tree of an issuer of a corporate security. The issuer chooses a variety, which is given by a pair of a security type and a banker.

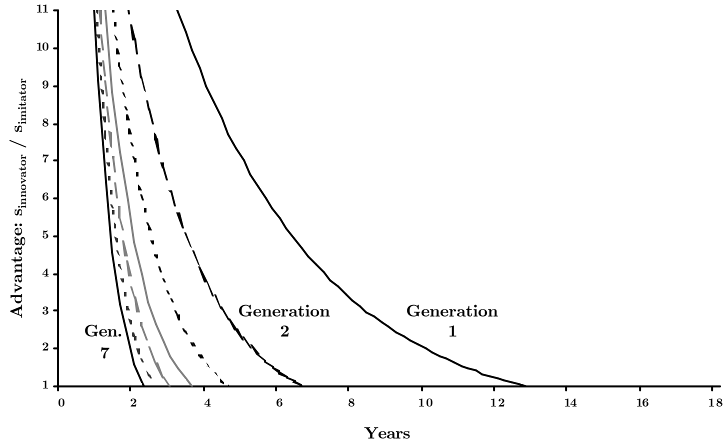

Figure 9: Estimated Advantage to the Innovator over Time and Generations (nested logit demand; $t = 8$)

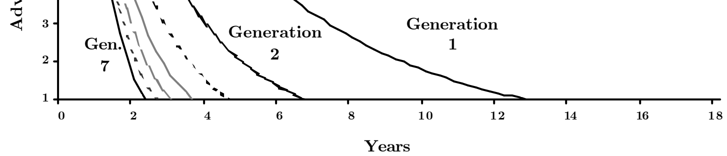

Figure 10: Estimated Advantage to the Innovator over Time and Generations (nested logit; $t = 11$)

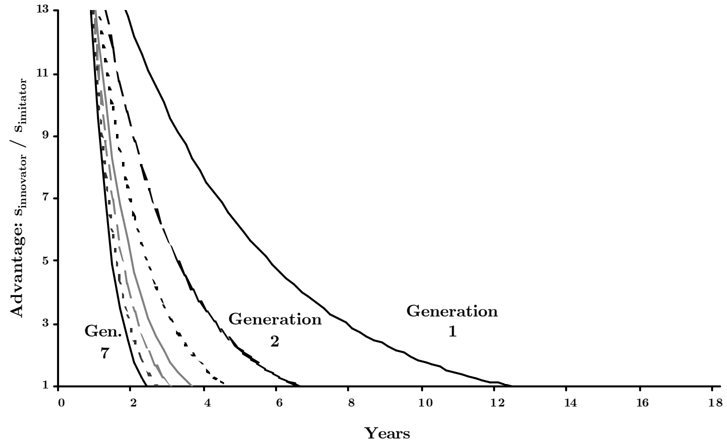

Figure 11: Estimated Advantage of the Innovator over Time and Generations (nested logit; $t = 12$)

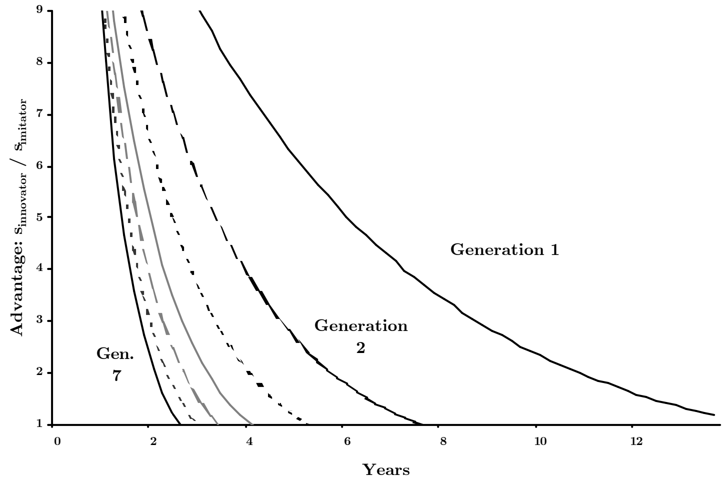

Figure 12: Estimated Advantage to the Innovator over Time and Generations (nested logit; $t = 16$)

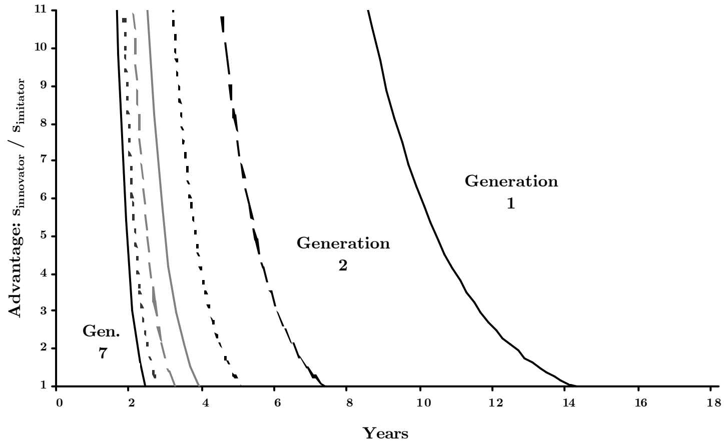

Figure 13: Estimated Advantage to the Innovator over Time and Generations (nested logit with issuer heterogeneity; $t = 8$)

Table 1: Sizes of the New Issues Markets using Standard Equity and Equity-Linked Products between April 1985 and March 2001

Time	**Underwritten Principal**		**Average Deal Size**	
Period	**Standard Equity**	**Equity-Linked and Derivative Products**	**Standard Equity**	**Equity-Linked and Derivative Products**
1	64,477	3,915	38	489
2	61,034	590	36	84
3	35,801	4,120	48	589
4	45,123	9,314	46	388
5	61,216	19,517	57	887
6	99,507	10,750	57	336
7	129,073	22,106	56	287
8	90,397	22,414	56	270
9	139,518	32,357	61	225
10	169,569	35,463	83	269
11	143,016	19,616	112	265
12	230,734	20,680	381	440

Figures in millions of current US$

Aggregation over 12 periods between April 1985 and March 2001.

Table 2: Classification of Equity Linked and Derivative Corporate Securites

Family Description	Securities in the Family
Debt Products	RISRS.
Zero Coupon-Convertible Debt	LYONS.
Dividend Paying Convertible Debt	SIRENS, ICONS.
Convertible Preferred Securities	PERCS, YES Shares, DECS, ACES, X-Caps, PRIDES, PEPS, SAILS, Automatic Common Exchange Securities, STRYPES, MARCS, PEPS, MEDS, Trust-Originated Convertible Preferreds, TRACES.
Short Term Tax-Advantage Preferred	FRAPS.
Tax-Advantage Preferred or Debt	MIPS, EPICS, MIDS, TOPRS, QUIDS, QUIPS, QUICS, Res-Caps, COPRS.
Convertible Tax-Advantage	Convertible MIPS, TECONS, Convertible TOPRS, QDCs, EPPICS, TRUPS, Convertible QUIPS.
Index-tied Principal	PERLS, SIRS, MITTS, SMARTS, Equity Participation Securities, CPNs, SUNS, CUBS.
Stock Appreciation Tied-Principal	ELKS, YEELDS, CHIPS, PERQS.
Privatization Exchangeable Debt	PENs.
Trust-Originated Pass-Throughs	STOPS.

Table 3: Innovators' Market Shares for Imitated Securities

Product	Innovator	Number of Rivals	Share of Deals (%)	Leader	Share of Principal (%)	Leader
RISRS	Kemper Securities	1	43	No	50	Yes (Tied)
SIRS	Paine Webber	1	67	Yes	90	Yes
DECS	Salomon-Smith Barney	1	94	Yes	79	Yes
Equity Participation Securities	Merrill Lynch	1	94	Yes	50	Yes (Tied)
MIDS	Goldman, Sachs	2	29	No (2)	30	No (2)
SMART Notes	Merrill Lynch	2	60	Yes	41	Yes
X-CAPs	Merrill Lynch	2	67	Yes	92	Yes
ELKS	Salomon-Smith Barney	2	82	Yes	90	Yes
PERCS	Morgan Stanley	2	82	Yes	88	Yes
QIDS	Goldman, Sachs	2	82	Yes	76	Yes
PERLS	Morgan Stanley	2	93	Yes	97	Yes
LYONS	Merrill Lynch	2	97	Yes	95	Yes
FRAPS	Merrill Lynch	3	22	No (2)	23	No (2)
RST-CAPS	Lehman Brothers	3	25	Yes (Tied)	22	No (2)
MIPS	Goldman, Sachs	3	89	Yes	96	Yes
TOPRS	Merrill Lynch	3	95	Yes	92	Yes
TRUPS	Salomon Brothers	4	71	Yes	72	Yes
Convertible TOPRS	Merrill Lynch	6	47	Yes	33	No (2)
Trust-Originated Convertible Preferreds	Robertson	7	6	No (5)	5	No (4)
Total Number of Leads (of 18 cases)				15		14

Table 4: Ratio of Principal Underwritten by Imitators to Innovators

Imitated Securities (number)	**Average Ratio**
First Generation (7)	0.337
All Generations (18)	0.679

Table 5: Paired Difference of Means Tests (Imitator minus Innovator) for Security Characteristics

Variable	**P-value (Mean $\neq 0$)**
Offer Yield to Maturity	0.052
Yield Advantage	0.025
Years before Called at Par	0.203
Percentage Yield	0.001
Years of Call Protection	0.543
Initial Call Price	0.001
Conversion Shares per Preferred Share	0.943

Table 6: Within-Standard Deviation of Some Security Characteristics for Innovators and Imitators

Variable / Available Observations	**Imitators**	**Innovators**
Offer Yield to Maturity	0.779	12.949
N	46	418
Spread over Treasury Bills	25.420	87.528
N	10	31
Years of Call Protection	4.055	1.772
N	31	407
Years to Par Call	1.043	2.703
N	23	296
Yield Advantage	0.840	3.610
N	8	167
Percentage Yield	0.858	15.569
N	35	288

Table 7: Paired Difference of Means Test for Imitators' Innovator's Underwriting Spreads

Paired Difference	**Mean**	**Standard Error**	**P-value (Mean < 0)**
Imitator - Innovator Spread	-0.063	0.0573	0.137

Table 8: Estimation Results with Logit Demand

Dependent variable is $\ln(s_j) - \ln(s_o)$.
Regressions include time and group dummies.
Instruments are other varieties' characteristics..
Huber/White's Consistent Estimators for Standard Errors
(with heteroskedasticity and within-security correlation)

Parameter Estimates	Average Advantage	Dynamics of Advantage
α	0.735^{***}	0.783^{***}
Total Innovations	0.075^{**}	0.842^{**}
Total Innovations in Group	-0.359^{**}	-0.361^{**}
Issuer is Innovator	2.010^{*}	4.433^{*}
- interacted with generation number	–	0.177^{*}
- interacted with deal number and generation	–	-0.334^{*}
Number of Observations	323	323
Adjusted R-squared	0.292	0.324
F-statistic	1587.64^{*}	11.85^{*}

P-values: $^{*} \leq 0.01, ^{**} \leq 0.05, ^{***} \leq 0.1$.

Table 9: Own-Price Elasticities in the Logit Model

	Average Advantage	Dynamics of Advantage
Median	2.018	2.151
Mean	1.834	1.955
Standard Error	0.797	0.850
Number of Inelastic Demands	50	49

Table 10: IV estimates for the base Nested Logit Demand Model

Dependent Variable is $\ln(s_{jt}) - \ln(s_{0t})$
All regressions include time and group dummies.
Instruments are other varieties' characteristics and other bank's characteristics.
Huber/White's Consistent Estimators for Standard Errors
(with hetersokedasticity and within-security correlation)

Parameters	$t = 16$	$t = 12$	$t = 11$	$t = 8$
α	1.598**	1.025**	1.025***	1.85
σ	0.631*	0.691**	0.615***	0.729*
Innovations by Bank	0.250	0.042***	0.045***	0.023
Innovator Dummy	2.657*	2.824*	2.474***	3.068***
- interacted with:				
generation number	0.110*	0.160*	0.114*	0.128*
generation number and time	−0.192**	−0.318*	−0.303*	−0.500**
n	418	323	312	225
OIR test	20.399	14.567	28.579	10.801
(p-value)	(0.007)	(0.024)	(0.000)	(0.303)
Inelastic demands	9	10	10	4
Average Elasticity	11.064	8.227	7.503	16.812
(standard error)	(4.729)	(3.596)	(2.899)	(7.649)
Adjusted R^2	0.145	0.290	0.273	0.065
F-statistic	330.11*	12.30*	11.39*	248.05*

P-values: $^* \leq 0.01, ^{**} \leq 0.05, ^{***} \leq 0.1$.

Table 11: IV estimates for the Nested Logit Demand with Firm Heterogeneity

Dependent Variable is $\ln(s_{jt}) - \ln(s_{0t})$
All regressions include time and group dummies.
Instruments are other varieties' characteristics and other bank's characteristics.
Huber/White's Consistent Estimators for Standard Errors
(with hetersokedasticity and within-security correlation)

Parameters	$t = 16$	$t = 12$	$t = 11$	$t = 8$
α	1.966^{**}	1.918^{**}	0.933^{***}	1.417^{***}
σ	0.510	0.655^{***}	0.887^{**}	0.610^{***}
Innovator Dummy	5.751^{*}	5.379^{*}	4.335^{***}	5.824^{*}
- interacted with generation number	0.155^{*}	0.209^{*}	0.009^{**}	0.172^{*}
- interacted with generation number and time	-0.396	-0.525^{*}	-0.532^{*}	-0.847^{*}
Price interacted with:				
Market Capitalization	$1.39e^{-5*}$	$2.22e^{-5*}$	$1.25e^{-5***}$	$3.04e^{-5*}$
Proportion of Preferred Stock	0.059^{*}	0.038^{*}	0.018^{*}	0.047^{***}
n	299	261	250	177
OIR test	2.392	16.078	28.579	6.584
(p-value)	(0.972)	(0.050)	(0.000)	(0.708)
Inelastic demands	9	7	7	5
Average Elasticity	9.632	13.863	20.775	8.907
(standard error)	(0.972)	(6.269)	(9.424)	(4.259)
Adjusted R^2	0.295	0.128	0.270	0.345
F-statistic	175.56^{*}		5.96^{*}	8.98^{*}

P-values: $^{*} \leq 0.01, ^{**} \leq 0.05, ^{***} \leq 0.1$.

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