

IPO Underpricing over the Very Long Run

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ABSTRACT

A central measure of the efficiency of the Initial Public Offering (IPO) market is the extent to which issues are underpriced. We present new and comprehensive evidence covering British IPOs since World War I. During the period from 1917 to 1945, public offers were underpriced by an average of only 3.80%, as compared to 9.15% in the period from 1946 to 1986, and even more after the U.K. stock market was deregulated in 1986. The post-WWII rise in underpricing cannot be attributed to changes in firm composition, and occurred in spite of improvements in regulation, disclosure, and the prestige of IPO underwriters.

WHEN DOMINO'S PIZZA had an initial public offering (IPO) in the United Kingdom in November 1999, its shares started trading at a 78% premium to the offer price. While there is anecdotal evidence of similarly large premia in previous hot markets, such as Ford Motor Company's offering of its European subsidiary on the London Stock Exchange (LSE) in December 1928, which recorded an 87% first-day premium, it is not known whether IPO underpricing was commonplace early in the last century.¹ As early as 1929, large initial premia of IPOs were highlighted by *The Economist* (27 July), among others. However, the first empirical study of the pricing of IPOs on the London Stock Exchange was not published until 1967, when Merrett, Howe, and Newbould (1967) revealed underpricing of 17.2% on public offers between 1959 and 1963. The earliest study of IPO pricing in the United States examined a sample of Regulation A

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¹ The only evidence on IPO pricing during the early 20th century relates to pre-World War I Germany, namely, the studies by Schlag and Wodrich (2000), Fohlin (2000), and Burhop (2008).

equity offerings in 1957, 1959, and 1963 (Stoll and Curley (1970)) and was followed by studies more tightly focused on the initial returns of all IPOs (Logue (1973), Ibbotson (1975)). Subsequent research has confirmed underpricing as a consistent feature of stock markets in both countries.²

The contribution of this paper to the extensive literature on IPO underpricing is to assemble and analyze a new data set of equity IPOs on the LSE from World War I (WWI) up to the present. The last century of U.K. IPOs can be divided into three subperiods: 1917 to 1945, post-WWII (1946 to 1986) and post-Big Bang (1987 to 2007).³ We find that underpricing of public offers in the period 1917 to 1945 averaged only 3.80%, as compared to 9.15% in the period 1946 to 1986. This substantial increase is robust to the inclusion of variables controlling for changes in firm risk and method of issue, improvements in disclosure, and the emergence of prestige underwriters. In the 21 years since 1986, underpricing has been even higher, averaging 19.00% for all IPOs.⁴

Around 1900 London was the preeminent international financial center: The British stock market was larger relative to GDP than in the United States, and was the second largest exchange in the world (Rajan and Zingales (2003)). As well as being interesting in its own right, the attraction of a long-run study of British IPOs lies in the dominance of the fixed offer price regime for much of the last century. In contrast, the U.S. market had moved to book-building IPOs much earlier.⁵ In examining how underpricing changed over time, we consider whether improvements in investor protection and underwriting have resulted in lower underpricing over the course of the last century. Although this process was slow to get underway, IPO investors were considerably better protected after 1945 due to substantial reforms in company law, accounting standards, and the LSE's own rules. Similarly, reputable banks committed themselves to underwriting IPOs after 1945.

Over the long haul there has thus been a narrowing of information gaps, reflecting better regulation and disclosure as well as the benefits of certification. Other things being equal, we would expect this to have moderated the level of underpricing over time. However, the rise in underpricing documented in this paper suggests that any marginal benefits from better regulation, disclosure, and certification were outweighed by other developments in the IPO market. We argue that among such developments there was deterioration in the level of trust between investors, issuers, and sponsors. Consistent with the erosion of trust, investment banks increased their market power, managers' incentives

² For example, Ibbotson, Ritter, and Sindelar (1994) and Loughran and Ritter (2004) in the United States; and Davis and Yeomans (1974), Dimson (1979), Buckland and Davis (1989), Jenkinson and Trundle (1990), Levis (1993), Ljungqvist (2003), and Unlu, Ferris, and Noronha (2004) in the United Kingdom.

³ The Big Bang refers to the deregulation of fixed brokerage commissions and the termination of restrictions on membership on the LSE (Thomas (1986)). It was at least as important for Britain as the liberalization of fixed commissions in 1975 was to the U.S. markets.

⁴ Following the Big Bang, categorization of each IPO into either a public offer or a placing lost significance. IPOs typically combined a placing to institutions, frequently by way of book-building, with a fixed price offer to retail investors.

⁵ See Ritter (1987). On a proceeds-weighted basis 88% of IPOs between 1977 and 1982 were already book-built.

were realigned as investment became institutionalized, and the winner's curse was exacerbated as investors became more heterogeneous after WWII.

In the post-Big Bang period (1987–2007), headline underpricing has continued to rise to 19.00%. Although this overall figure has been propelled by substantial underpricing of smaller firms, first on the Unlisted Securities Market (USM) with underpricing of 19.77%, and then on the Alternative Investment Market (AIM) with underpricing of 22.17%, IPOs on the main market have also displayed higher underpricing (13.35%). We choose to concentrate our analysis on the period when the fixed price offer method was dominant from WWI up to the Big Bang. Recent underpricing behavior in the United States has been extensively analyzed in the literature, and the U.K. experience has been similar. Furthermore, the fundamental shift in issue method to book-building following the Big Bang makes an integrated analysis of the whole 20th century problematic.

The paper is organized as follows. In Section I, we discuss the historical improvements in investor protection and underwriting. Section II reviews the literature on underpricing and sets out a simple linear model of underpricing relevant to the period between WWI and the Big Bang. In Section III we describe the data. Section IV presents our main findings. Section V discusses possible explanations for the underpricing puzzle, and Section VI concludes.

I. Historical Background

Over the span of the last century, with the notable exception of the dominant fixed offer price method, the London IPO market experienced profound structural change via improved investor protection, increased prominence of reputable investment banks, the decline of provincial IPO markets, and the rise of institutional investment. In this section, we discuss these developments in turn.

A. Fixed Offer Price

Benveniste and Wilhelm (1990) and Loughran, Ritter, and Rydqvist (1994) show the importance of different regulatory environments for underpricing. The IPO market on the LSE operated under a fixed offer price regime from at least WWI until the Big Bang in 1986. Under this regime the issuing firm and its sponsors set the offer price and made no adjustment to balance demand and supply once marketing began. A second important characteristic of this regime was the pro rata allocation of shares in the event of oversubscription of an IPO. The Big Bang induced competition in the securities business generally, and in IPO underwriting specifically, by allowing any bank including U.S. investment banks to own an LSE member firm. Thereafter, book-building became a more important IPO method in London (see Ljungqvist (2003), p. 24 and endnote 25).

B. Investor Protection

According to La Porta, Lopez-de-Silanes, Shleifer, and Vishny (LLSV), securities laws matter for financial development. In particular, the legal origin of

a country and the degree of protection extended to minority investors against managers and dominant shareholders (“antidirector rights”) explain the variation in stock market size (LLSV (1997)) and share ownership concentration (LLSV (1998)) across a sample of 49 countries at the end of the last century. In subsequent research (La Porta, Lopez-de-Silanes, and Shleifer (2006)), they argue that the presence of a public enforcement body, for example, the Financial Services Authority in Britain, is only necessary as a substitute for weak laws. On a scale running from zero to one, LLSV (1998) and La Porta et al. (2006) estimate the U.K. scores for antidirector rights, mandatory disclosure requirements, and liability standards imposed on managers, underwriters, and accountants alike as 0.83, 0.83, and 0.66, respectively. At the end of the 20th century, Britain scores relatively highly in the regulation and disclosure of its listed securities, including IPOs.

Across the period considered by this study, Britain’s regulatory and disclosure development has been signposted by the passage of the Companies Acts of 1929, 1948, and 1967, together with the Financial Services Act of 1986. The 1929 Act had less impact than did subsequent legislation. Formally, this Act required any auditor’s report in a prospectus to detail the last 3 years’ profits for an issuing firm, as well as to disclose use of proceeds, director compensation and inside ownership, material contracts, and related party transactions. Crucially, however, it did nothing to prevent the manipulation of company accounts. It is therefore highly debatable whether this legislation would have prevented the occurrence of the high-profile Royal Mail scandal of the late 1920s, an event underlining the shocking extent to which profit figures could be manipulated (Davies and Bourn (1972)), and the Enron of its day. In fact, corporate accounting disclosure improved very little before the publication of the recommendations of the Cohen Committee on Company Law Reform in 1945 in the run-up to the passage of the 1948 Companies Act. In keeping with its evidence to this Committee, the accounting profession was urging reform from at least the end of WWII (Richards (1989)). Consequently, the significant improvements delivered by the Act, namely, mandatory consolidated accounts, an end to hidden reserves, and the establishment of the “true and fair view” principle in accounting (Arnold and Matthews (2002)) were already diffusing through corporate Britain several years before 1948.

Consistent with this timeline of improved financial disclosure, Franks, Mayer, and Rossi (2009) argue that two other aspects of investor protection in Britain, namely, antidirector rights and liability standards of directors and advisers, did not improve significantly until the second half of the 20th century. A simple average of their estimated LLSV scores for antidirector rights, liability standards, and disclosure requirements summarizes this time trend and highlights the importance of the 1948 Act.⁶ The latter introduced proxy voting

⁶ This mean score is 0.06 (pre-1929), 0.28 (1929), 0.61 (1948), 0.67 (1967), and 0.78 (1986). The scores for public enforcement are excluded since, as La Porta et al. (2006) argue, this measure is a substitute for the other three. The 1929 score incorporates a disclosure score of 0.33 representing our belief that the improvement in disclosure in that year was more modest than that claimed by Franks, Mayer, and Rossi (2009).

by mail, facilitated the calling of an extraordinary shareholders' meeting with as few as 10% of votes, and relaxed the standard of proof of directors' liability for untrue statements in a prospectus.

Complementing company law, the LSE regulated the behavior of its members and of listed companies through its *Rules and Regulations of the Stock Exchange* (LSE Rules)⁷ up until the enactment of the Financial Services Act in 1986. On the eve of World War I, the LSE rules dealt only with firms seeking an Official Quotation. As such, a high proportion of new issues occurred without a prospectus (Lavington (1921)) and without publication of their share prices. In 1915, the government finally required the LSE to publish a Supplementary List of the prices of those securities without an Official Quotation (King (1947), pp. 75–76). At the end of the war, the LSE required that all IPOs seek its permission, and that an advertised statement in lieu of a prospectus be placed in the press before such permission was granted (Michie (1999), p. 265). However, no accounting disclosure was mandated for Supplementary List IPOs by the LSE Rules before 1929, nor was there any requirement, similar to that for Official Quotations, that two-thirds of an issue be placed in the hands of public investors. In brief, listing requirements were extremely lax prior to 1929. When the 1920s hot issue market peaked, investors failed to price-protect themselves against low-quality offerings, a state of affairs evidenced by the poor survival rate of the 1928 IPO cohort (Harris (1933)).

The significant tightening of LSE Rules and their enforcement did not come until after 1945 (Michie (1999), pp. 265–266). Minimum listing criteria such as the number of years of historic profits to be disclosed (“track record”) and the minimum percentage of the firm’s equity to be issued to the market were successively raised. By 1951, issuing firms were required to disclose a 10-year track record and the LSE discouraged applications from firms unable to meet this requirement. After 1972 issuing firms were still required to disclose a 5-year track record, and at least 25% of a firm’s equity had to be offered to the public. As well as tightening minimum listing criteria, the LSE made greater efforts to discourage the use of private placements (“placings”) after 1945, believing them to lack the transparency and fairness of public offers (Michie (1999), pp. 414 and 476). Encouraged by the success of NASDAQ in the United States, a junior market, the Unlisted Securities Market was established in 1980. Any firm seeking entry to the USM now only required a minimum offering of 10% of its equity, as opposed to 25% on the main market. This innovation helped the LSE maintain its strict requirements for a full listing.

In summary, both investor protection and listing requirements were extremely weak before 1945. Thereafter, company law improved investor protection and the LSE raised disclosure standards for companies going public on the main market.

⁷ The first fully printed rule book dates from 1812. Subsequent editions were not numbered. Covering the period of this study, we located editions for 1915, 1918, 1922, 1926, 1927, 1928, 1929, 1934, 1946, 1951, 1968, and 1969; after 1973, it became the *Admission of Securities to Listing* (the “Yellow Book”).

C. Investment Banks

The most important development in the underwriting market before the Big Bang was the post-WWII application of reputable capital to the underwriting of IPOs. Up until 1929, 30% of IPOs were not underwritten at all, and underwriting was conducted by an assortment of company promoters, syndicates, company directors, stockbrokers, and a new breed of industrial trust. There were considerable doubts about the capital backing of underwriters, especially when such information was not made public (Finnie (1934), pp. 137–60; *The Economist*, 5 July 1924, p. 13). As the fallout from the 1928 IPO boom illustrated well (Harris (1933)), there were too many underwriters with insufficient capital or interest in building a sound reputation. The merchant banks, the most reputable of whom sat on the Accepting Houses Committee (AHC), established in 1914, were slow to begin underwriting equity IPOs. Before 1914, these banks had been very active in underwriting foreign bond issues, but, despite the contraction of this business in the interwar years, they were reluctant to commit themselves to underwriting industrial IPOs (Roberts (1992)). This reluctance contrasts with the support extended by both U.S. private banks (Ramirez (1995)) and German universal banks (Fohlin (1998)) to their respective industrial clienteles.

This situation changed in 1945 with the establishment of the Issuing Houses Association (IHA), intended to represent the interests of new issue underwriters to the regulatory authorities. Although membership quickly rose to around 50 and stayed at that level until shortly after the Big Bang, the merchant banking members of the AHC, led by Barings and Rothschilds, continued to represent the most reputable names in the City and were at the IHA's core. In the following sections, we define prestigious underwriters by membership of the AHC, total membership of this body remaining at 17 for much of the period from 1945 to 1986.

D. Provincial IPO Markets

Notwithstanding the considerable IPO activity on the Provincial Stock Exchanges (PSEs) prior to WWII, the LSE was first choice for many firms seeking a listing by the interwar period (Thomas (1973)).⁸ After 1945, provincial activity declined. Ghandi (1964) was able to trace only 379 IPOs of mainly ordinary shares (common stocks) between 1951 and 1960, compared to 693 IPOs launched on the LSE according to our own data over the same period.⁹

Offerings on the PSEs were substantially unregulated before 1914. However, toward the end of the interwar years the main PSEs, Birmingham, Liverpool and Manchester, moved rapidly toward adopting the listing requirements of

⁸ The quantitative evidence in Thomas (1973, pp. 249) regarding “provincial” new issues in the interwar years relates predominantly to issues on the LSE in the distribution of which a provincial broker participated.

⁹ These figures include introductions, where a firm with a sufficiently widely dispersed share register may apply for a listing without an accompanying share issue.

the LSE (Thomas (1973)), and after WWII, all the PSEs effectively fell into line with LSE regulations regarding IPOs. Between 1964 and 1966, the 15 most important PSEs merged into three regional exchanges, Northern, Midland and Western, and Scottish, before formally merging with the LSE in 1973. In brief, despite the LSE's importance, provincial firms had a degree of choice as to where to list until the mid-1960s.

E. Rise of Institutional Investment

Notwithstanding Scott's (2002) claim that institutional investment in equities had its origins in the interwar years, private investors still accounted for around 80% of LSE trading volume at the end of the interwar period (Michie (1999), p. 178). Institutional share ownership continued its rise in the 1950s and finally surpassed the holdings of private individuals in 1975 (Central Statistical Office (1995)). Together with the improved disclosure provisions of the 1948 Companies Act (Hannah (1983)), this shift contributed to the emergence of a market for corporate control in Britain.

Summarizing Section I, during the period from WWI to the Big Bang in 1986, fixed offer price methods dominated in the United Kingdom. In the first half of the last century, investor protection and listing requirements were weak, and underwriting practices were underdeveloped. The second half of the last century witnessed advances in both the latter areas, as well as the disappearance of provincial IPO activity and the rise to prominence of the institutional investor.

II. An Empirical Model of Underpricing

Most models of underpricing are based on the premise that an issuing firm wishes to maximize the gross proceeds of its IPO, subject to meeting stock exchange requirements such as the establishment of a liquid market in the shares. We define underpricing, or the first-day return (RET_{i1}), for firm i as the change from the initial offer price (P_{i0}) to the final price recorded on the first day of trading (P_{i1}):

$$RET_{i1} = (P_{i1}/P_{i0}) - 1. \quad (1)$$

The greater the underpricing, the lower the gross IPO proceeds and therefore the greater the money that issuing firms, and selling shareholders in particular, have "left on the table." Theories and empirical tests that attempt to explain this underpricing are reviewed by Jenkinson and Ljungqvist (2001), Ritter and Welch (2002), and Ljungqvist (2007), among others.

Many models reflect the contemporary institutional framework of the IPO market, but cannot explain the persistent underpricing revealed by our research. Benveniste and Spindt's (1989) theory of information revelation provides important insights into book-building and underpricing. While recent papers confirm the value of these contributions to the IPO literature, the

Benveniste-Spindt model is not relevant to a market operating under a fixed offer price regime, as was the case for the United Kingdom over most of the last century. Similarly, Stoughton and Zechner (1998) argue that managers will maximize the value of their stake in the company by attracting a large controlling shareholder, but again this works best under a book-building regime. Allen and Faulhaber's (1989) and Welch's (1989) signaling explanations are precluded by the adoption of preemptive rights by U.K. quoted companies in the second half of the last century, since the pricing of rights issues is wealth-neutral (Jenkinson and Ljungqvist (2001), p. 79). Asquith, Jones, and Kieschnick's (1998) assertion that underpricing is in part a manifestation of price support during initial trading does not apply to a pre-Big Bang era lacking in large, integrated, and capital-backed investment banks, which in turn made systematic price support improbable. Tinic's (1988) claim that underpricing alleviates the risk of litigation by disgruntled investors is contentious (Drake and Vetsuypens (1993)), and ignores the fact that litigation is extremely unlikely under the British legal system (Jenkinson (1990)). Finally, behavioral explanations such as the prospect theory of underpricing, advanced by Loughran and Ritter (2002), are better for explaining hot issue markets than structural changes in underpricing over time.

In Table I, we summarize the main underpricing hypotheses that are relevant to the fixed offer price regime on the LSE and for which a suitable variable is

Table I
Testable Hypotheses to Explain Underpricing

The variables below are used in the literature and in this paper as explanations for IPO underpricing or the first-day return, *RET*, which is defined as the change in share price from the offering price to the end of the first day of trading. More detailed definitions of the explanatory variables are provided in Section II of the paper.

Hypothesis	Explanatory Variable	Variable Name	Impact on Underpricing
1. Ex ante uncertainty			
(a) Firm risk	Firm age in years	<i>AGE</i>	—
	Post-IPO market capitalization of all outstanding voting shares at the offer price	<i>MCAP</i>	—
	Ratio of book value to offer price	<i>BVP</i>	—
(b) Technology risk	R&D (dummy variable)	<i>RD</i>	+
(c) Industry risk	12 industry sectors	<i>SECTOR</i>	±
2. Certification	Underwritten by third party (dummy variable)	<i>UW</i>	—
	Reputable underwriting (dummy variable)	<i>PRESTIGE</i>	—
3. Disclosure	Length of profit record in years	<i>TRACK</i>	—
4. Realigned incentives	Proportion of post-issue voting equity sold at IPO	<i>PROPSOLD</i>	—

available. Beatty and Ritter (1986) argue that underpricing should increase in the ex ante uncertainty of the firm's value where investor heterogeneity exists. Ritter (1984) and Loughran and Ritter (2004) highlight changes in firm risk as one explanation for shifts in underpricing over time. We use three proxies for firm risk: the size, age, and valuation of the issuer. Size is measured as the natural logarithm of voting stock market capitalization at the offer price in end 2007 prices, *LNMCAP*. Firm age is calculated from the foundation of the underlying business, where disclosed, or the date of incorporation of the firm, which usually occurs later, and is expressed as a natural logarithm, $LN(1 + AGE)$. Firm valuation is measured by the natural logarithm of the ratio of book value to the offer price per share, *LNBVP*, where book value is the proforma post-IPO net asset value per share held by voting shareholders. Additional measures of ex ante uncertainty include industry risk, proxied by the sector classifications from the *Stock Exchange Daily Official List* (*SECTOR*), and technology risk, defined as a dummy variable indicating whether the prospectus refers to the company undertaking research and development (*RD*).¹⁰

Certification by prestigious underwriting banks provides reassurance to investors about the IPO and might therefore reduce underpricing. However, the empirical evidence on this effect is sensitive to the choice of time period. While Carter, Dark, and Singh (1998) provided empirical support for bank reputation reducing U.S. underpricing in the 1980s, Loughran and Ritter (2004) and others have shown that the opposite was true in the 1990s. We model the impact of certification by employing two dummy variables: the first (*UW*) takes the value of one when an IPO is underwritten by a third party, and zero otherwise, and the second (*PRESTIGE*) takes the value of one when an IPO is underwritten by a member of the AHC (see Section I.C above), and zero otherwise.

Underwriters of public offers are typically at risk for between 10 and 14 days. Placings, where a bank (or broker) buys the shares at an agreed price ahead of sale to the final investor, are regarded as "underwritten," and reduce the bank's risk to a much shorter period. Better accounting disclosure is also important in minimizing information gaps. The number of years of historic profits is extracted from the prospectus (*TRACK*),¹¹ while a dummy variable controls for whether the proforma net asset valuation has been subject to independent scrutiny by an auditor or professional property appraiser (*AUDIT*).

Underpricing can reflect the magnitude of agency problems affecting investors and issuing firms, and the extent to which incentives are aligned. Habib and Ljungqvist (2001) postulate a realignment of incentives hypothesis according to which underpricing varies indirectly with the proportion of the offering that is represented by disposal of insider shares, the assumption being that

¹⁰ Disclosure of R&D expenditure in company accounts did not become customary until 1977 under the U.K. accounting standard SSAP 13. In the interwar years, prospectuses rarely made explicit reference to research and development, terminology that had not yet been widely adopted in Britain, but did refer to patent ownership and activity that is taken as indicative of R&D activity.

¹¹ To be precise, we define *TRACK* as the number of years of historic profits plus $0.0001 * AGE$, where the latter is the issuer's age in years, as defined above. This tiny adjustment facilitates ordinal ranking of the *TRACK* variable.

managers are likely to care about the wealth effects of underpricing. Ljungqvist and Wilhelm (2003) refine this hypothesis by arguing for the additional importance of managers' percentage equity ownership in motivating them to act as a good agent for shareholders and minimize underpricing (though Loughran and Ritter (2004) assert that the value of their equity stakes are more important than the percentage ownership). Although there may be suspicions about the motivation for going public (Leland and Pyle (1977)), the expectation is that managers will care more about underpricing, the greater the proportion of the firm being sold. Furthermore, if it is costly to generate information to underpin IPO pricing (Sherman and Titman (2002)), there should be a tradeoff between the proportion of postissue voting equity sold in the offering (*PROPSOLD*) and the extent to which shares are underpriced.¹² We therefore examine how underpricing varies with *PROPSOLD*.

We employ the explanatory variables listed in Table I in a linear model of first-day IPO returns, *RET*, as follows:

$$\begin{aligned} RET = & b_1 \cdot LNMCAP + b_2 \cdot LN(1 + AGE) + b_3 \cdot LNBVP + b_4 \cdot TRACK \\ & + b_5 \cdot AUDIT + b_6 \cdot PROPSOLD + b_7 \cdot UW + b_8 \cdot PRESTIGE + b_9 \cdot RD \\ & + b_{10} \cdot PLACING + b_{11} \cdot SECTOR + b_{12} \cdot RESTRUCTURE \\ & + b_{13} \cdot MRET + b_{14} \cdot USM + b_{15} \cdot YEAR + \varepsilon. \end{aligned} \quad (2)$$

The error term, ε , is assumed to be i.i.d. normal. We use a dummy variable for the issue method (*PLACING*), which takes the value one if the IPO is a placing and zero otherwise. A vector dummy (*SECTOR*) covers each industry sector, with sector membership being denoted by a value of one. A second dummy (*RESTRUCTURE*) takes the value one when, as in the case of interwar prospectuses, restructuring obscures the proportion of the postissue voting equity being sold at IPO (*PROPSOLD*).¹³ Ritter and Welch (2002) and others note the influence of equity market conditions on underpricing, which is proxied by lagged market returns over 1 or 3 months prior to the first day of trading (*MRET*). A dummy variable taking the value one if the offering occurred on the USM (see Section I.B) controls for the weaker listing requirements required by this junior market after 1980. Finally, we include a vector of dummy variables indicating the calendar year in which the issue first traded (*YEAR*). Unless otherwise stated, all regressions reported below include a full set of *YEAR* dummies and *SECTOR* dummies for all industries represented in the IPO sample other than "Commercial, Industrial, etc." All regressions are conducted with a suppressed constant.

What impact would we expect the structural changes discussed in Section I to have had on underpricing? A contemporary view, informed by recent research,

¹² For offerings with varying proportions sold but with other characteristics held constant, we implicitly assume that the cost of inducing investors to participate in the IPO—namely, money left on the table—is a constant proportion of gross proceeds.

¹³ Prior to the end of 1945, there were 85 IPOs apparently selling all their voting equity (*PROPSOLD* = 100%). In at least some of these instances, the prospectus failed to make clear that insiders most likely participated in the offering.

is that better disclosure rules should have enabled outside investors to place greater faith in the information disclosed in the prospectus, and to feel less inclined to demand a substantial discount to the IPO's perceived value in return for taking shares. Analogously, stronger antidirector rights should have better equipped shareholders to resist "bad" management, minimizing the need for compensation by way of underpricing when a firm first comes to market. Finally, in line with the certification hypothesis, the introduction of reputable capital into IPO underwriting should have helped reduce underpricing. In sum, all three structural changes should have resulted in less underpricing after 1945 than before. With the model described by equation (2), we control for changes in the risk composition of the IPO sample and in issue method, and test the marginal effects of better disclosure (*TRACK*) and reputable underwriting (*PRESTIGE*). We also test whether underwriters of repute, together with better investor protection, reduced observed underpricing after 1945 compared to the interwar years.

III. Data

The primary sources for prospectus data covering IPOs on the LSE in the period 1917 to 1986 are the *Times Book of Prospectuses* (1917 to 1969), the Singer and Friedlander *New Equity Issue Statistics* (1970 to 1979), and the *Extel Book of New Issues* (1980 to 1986). Offer price and the number of shares offered are checked against the *Stock Exchange Year Books*, the *Issuing House Year Books*, and press reports in *The Times Digital Archive 1785 to 1985*. Stock prices used to calculate returns are taken from the *Stock Exchange Daily Official List* (SEDOL) and the *Financial Times*. We are unable to find stock prices on IPOs before the publication of the Supplementary List in 1915. The LSE recorded "marks" indicating prices, but not trading volumes at each price. Since SEDOL marks are not time-ordered, we use the simple average of these marks to estimate the first-day price until the publication of closing bid-ask prices became commonplace after 1945, when we switch to the closing midprice.

For comparison with recent IPOs, the 1917 to 1986 data set is extended with statistics for 1995 to 2007 sourced from Paleari et al. (2007). The 1987 to 1994 IPOs comprise hand-collected data (1987 to 1990) and data extracted from the quarterly KPMG New Issue Statistics database (1991 to 1994). While we have underpricing data for the whole period through to 2007, we choose not to undertake cross-sectional analysis of the 1987 to 2007 period, given the fundamental change in issue method to book-building, the fact that there are similarities between the United Kingdom and the United States in this later period, and that recent U.S. experience has been analyzed extensively.¹⁴ Instead, we focus

¹⁴ Unlu et al. (2004) and Levis (2008) document the similarity in U.K. and U.S. underpricing in the periods 1993–2001 and 1992–2004, respectively. Loughran and Ritter (2004) attributed much of the higher underpricing in the United States in the late 1990s to the spinning and the analyst lust hypotheses. While the same potential conflicts of interest existed, spinning was not a major factor in the United Kingdom (see FSA Consultation Paper 171, "Conflicts of Interest: Investment Research and Issues of Securities," February 2003, 1.3–1.4). However, analyst lust in all probability

on the period up to the Big Bang watershed, which marked the beginning of the end of the fixed offer price method, as discussed in Section I.

Accordingly, the annual time series of mean first-day returns ending in 2007 relates to 4,540 IPOs, both public offers and placings. The multiple regression analysis is based on 2,553 IPOs between 1917 and 1986.¹⁵ While recognizing that this does not fully reflect provincial IPO activity (Section I.D), we include 250 IPOs jointly listing on at least one Provincial Stock Exchange as well as London, and 62 IPOs jointly listing on one of the three regional stock exchanges and the LSE.¹⁶ There were 321 partially paid IPOs in the interwar years; thereafter there were none. These IPO returns are calculated on a fully paid basis, reflecting the fact that shareholders were obligated to pay the balance of the offer price (the “call”) when due.¹⁷

Consistent with previous underpricing studies, there are a number of data exclusions. First, we exclude 119 offers for sale by the tender method, given their intrinsically different procedure for price determination as compared to fixed price offers; see Derrien and Womack (2003) and Jagannathan and Sherman (2006). We exclude “penny” stock IPOs, defined as those with an offer price of 10 pence or less (after decimalization in 1972), or the equivalent predecimalization price of two shillings or less. Also excluded are IPOs of closed-end funds (known in the United Kingdom as investment trusts), transfers from a junior market, new lists by firms already quoted on another exchange, new lists by firms with a dispersed and broad prior stockholder base (known in the United Kingdom as introductions), IPOs that bundled a preference share and an ordinary share, and privatizations.¹⁸

The changes in average IPO characteristics across the whole period 1917 to 1986 are presented graphically in Figure 1.¹⁹ In Panel A, we see that firms

was a major factor, given that many of the same investment banks were active in both IPO markets and the same underlying incentive structures existed.

¹⁵ We include data on IPOs from Buckland and Davis (1989), Levis (1993), and proprietary sources, the first of which includes dividend yield data on 523 USM offerings, but not proforma net asset values. Following Dimson, Nagel, and Quigley (2003), we therefore infer book-value-to-price ratios from the dividend yields.

¹⁶ The 250 IPOs took place on a total of 18 PSEs up to July 1966 when the last regional exchange was formed, and of these, 189 IPOs listed on one or more of Birmingham, Edinburgh, Glasgow, Liverpool, or Manchester. In addition, there were almost 350 IPOs that listed solely on a PSE and published a prospectus in *The Times* prior to regionalization for which either share prices could not be found or disclosure regarding the placing price was inadequate.

¹⁷ Hence, for a partially paid share the value of the remaining call(s) discounted at the Treasury Bill rate over the time to call is added to the amount paid prior to initial trading; in addition, where a share is not quoted fully paid, the discounted value of outstanding calls is added to the partially paid share price. The returns on 44 partially paid IPOs, both public offers and placings, with undated calls were estimated assuming these calls would not be made.

¹⁸ We include 30 IPOs consisting of an ordinary share plus a deferred share in some combination. With only one unseasoned IPO in 1930 we include five seasoned equity offerings that were of comparable size to interwar IPOs.

¹⁹ In this and the subsequent analysis, 54 missing observations for firm age, 23 for book-value-to-price, 24 for underwriter reputation, and 1 for research and development activity are infilled with the mean value for each variable. In the case of book-value-to price observations that are nonpositive, we replace the four undefined values for *LNBVP* by winsorized estimates. In Section IV.E, we show that our results are robust to these procedures.

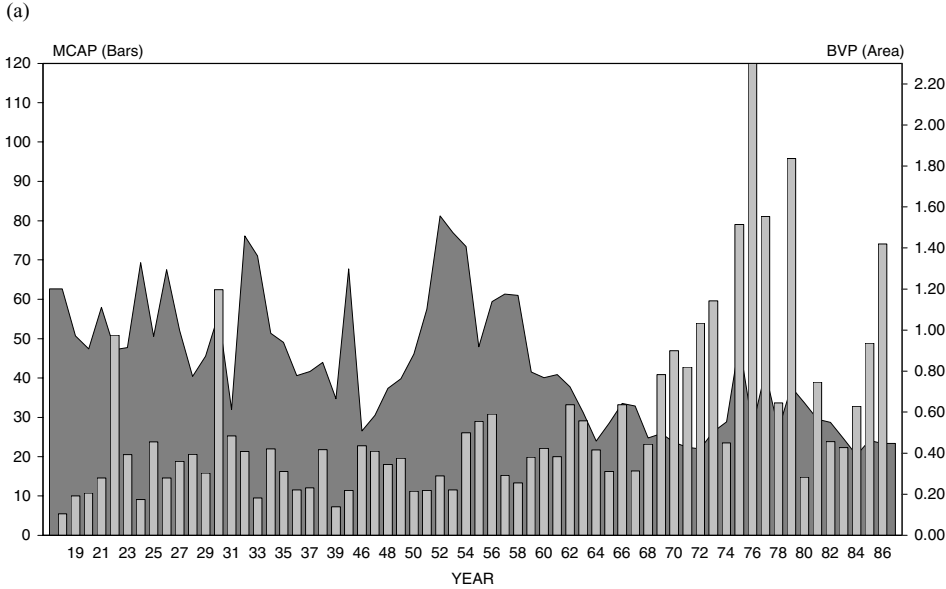


Figure 1A. Real market capitalization (LHS bars) and book value to price ratio (RHS area) of IPOs on the LSE, 1917 to 1986. Observations are equally weighted intrayear means except WWI (1917 to 1918) and WWII (1940 to 1945). There are no observations for 1915 and 1916. Both public offers and placings are included.

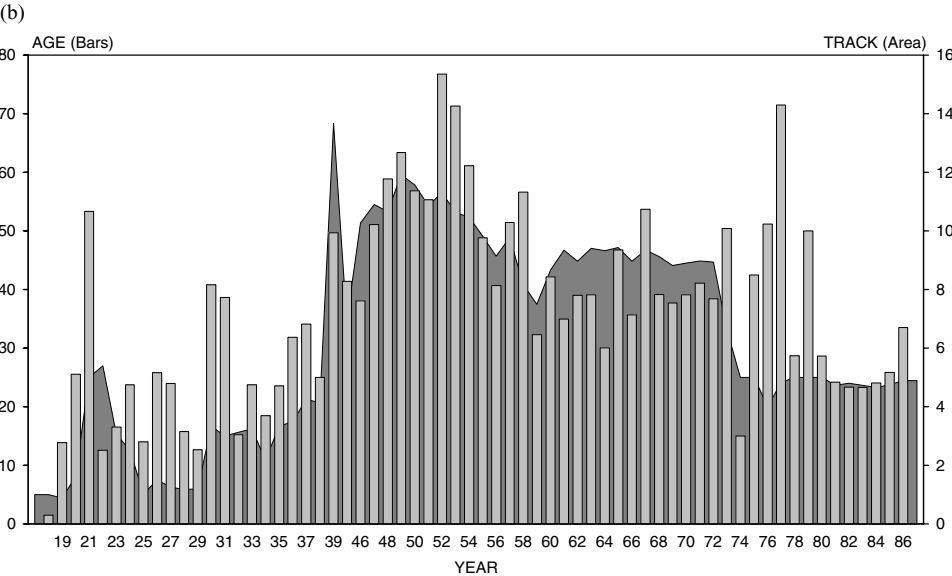


Figure 1B. Firm age at IPO (LHS bars) and length of track record in years (RHS area) of IPOs on the LSE, 1917 to 1986. Observations are equally weighted intrayear means except WWI (1917 to 1918) and WWII (1940 to 1945). There are no observations for 1915 and 1916. Both public offers and placings are included.

(c)

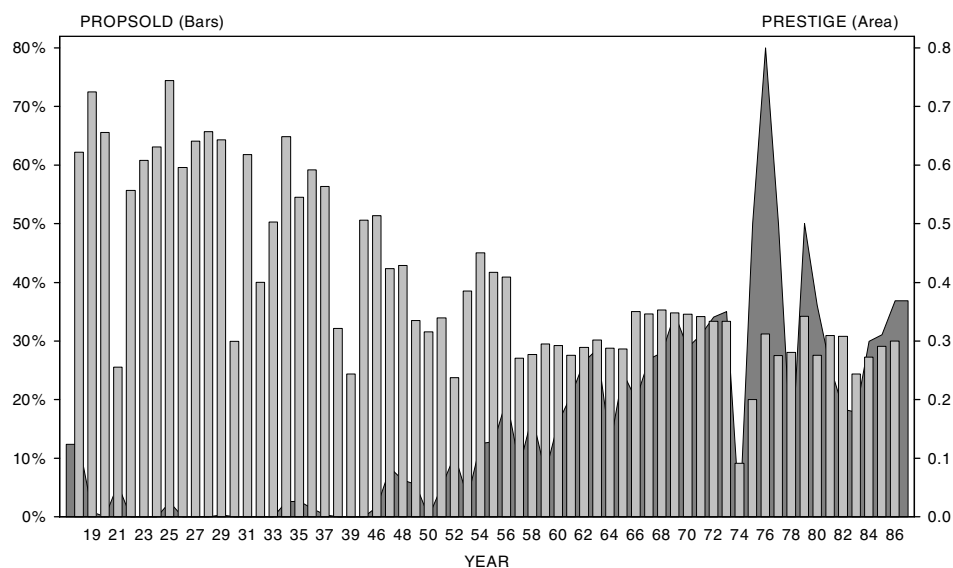


Figure 1C. Proportion sold at IPO (LHS bars) and underwriter reputation (RHS area) of IPOs on the LSE, 1917 to 1986. Observations are equally weighted intrayear means except WWI (1917 to 1918) and WWII (1940 to 1945). There are no observations for 1915 and 1916. Both public offers and placings are included.

(d)

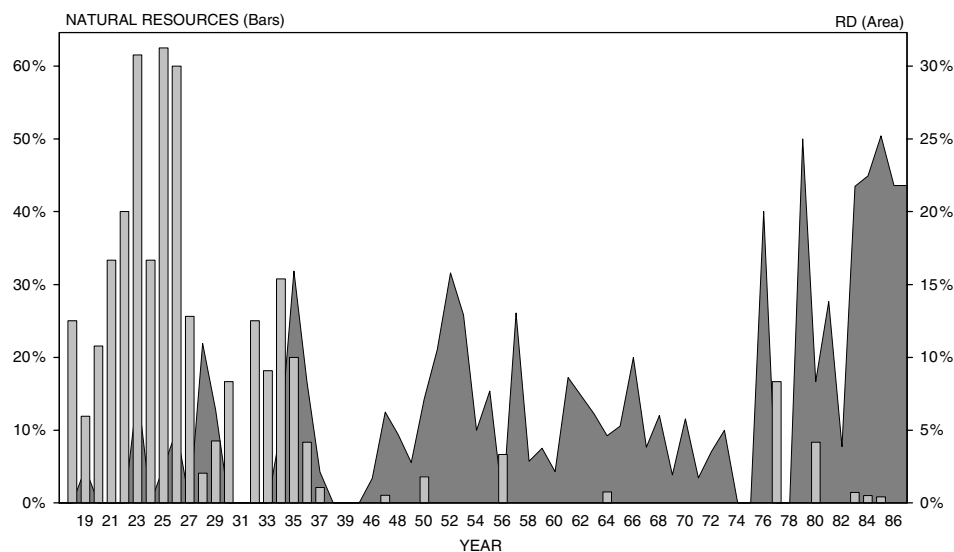


Figure 1D. Proportion of natural resource issues (LHS bars) and R&D intensity (RHS area) of IPOs on the LSE, 1917 to 1986. Observations are equally weighted intrayear means except WWI (1917 to 1918) and WWII (1940 to 1945). There are no observations for 1915 and 1916. Both public offers and placings are included.

going public became larger in terms of real market capitalization (*MCAP*), only experiencing a decline in the early 1980s with the start of the USM. They also became more highly valued, as indicated by the ratio of their book value per share to their offer price (*BVP*). In Panel B we see that, up to 1979, companies that had an IPO became older (*AGE*). The length of the audited profit record (*TRACK*) was longer post-WWII than in the interwar years, and then settled at 5 years from the early 1970s onward. Panel C reveals that the proportion of the firm that was sold (*PROPSOLD*) declined steadily over time. On the other hand, there was a marked move toward underwriters with a strong reputation (*PRESTIGE*) after 1945. Finally, Panel D shows that offerings of companies in the natural resource sectors of mining, oil, and plantations were important in the mid-1920s and mid-1930s, but not thereafter. The proportion of R&D-intensive IPOs was generally less than 10% of the sample, but became more important toward the end of the period. Other things equal, the trends in mean firm size, age, and underwriter reputation may be expected to have narrowed underpricing over time. In contrast, the trends in the mean proportion sold and in the mean firm valuation (lower *BVP*) may be expected to have widened underpricing over time.

The descriptive statistics and correlation matrix of first-day returns and the explanatory variables are included in Table II. In addition, we make use of the sector classification for each IPO (see Section II) and pre-IPO stock market returns.²⁰

IV. Results

A. Annual Time Series of First-Day Returns

The annual time series of IPO volume and first-day returns are summarized in Panels A to C of Table III.²¹ There were no IPOs in 1915 and 1916 and only four during 1917 and 1918, reflecting wartime capital market restrictions. Similarly, there were only 14 observations in our data set during the war years 1940 to 1945. IPO activity in the interwar years was not insubstantial, despite being understated due to the greater use of preference shares as well as the

²⁰ One- and 3-month U.K. equity market returns are calculated from the London and Cambridge Economic Service index (monthly data to August 1921), the Scholles 20 ordinary share index (weekly from August 1921 to December 1926), the *Bankers Magazine* index (monthly during 1927 and 1928), the Annalist London 20 share index (weekly from January 1929 to December 1929), and daily from 1930 from the *Financial News* 30, the *Financial Times* 30, and the *Financial Times* All Share indexes. The intention is to capture unanticipated stock market fluctuations, so it is appropriate that these 1- and 3-month returns measure capital appreciation only, excluding dividends.

²¹ For comparison with recent IPOs, the 1917 to 1986 data set is extended with statistics for 1995 to 2007 kindly supplied by Paleari, Piazzalunga, Redondi, Trabucchi, and Vismara (2007), to whom we are grateful. The 1987 to 1994 gap is filled using hand-collected data (1987 to 1990) and data extracted from the quarterly KPMG New Issue Statistics database (1991 to 1994). The post-1986 data were compared with statistics (for differing samples) from Jenkinson and Trundle (1990), Levis (1993, 2008), Ljungqvist (2003), and Unlu et al. (2004). Inconsistencies identified in the Paleari et al. (2007) data set were brought to the attention of the compilers and, where possible, corrected.

Table II
Descriptive Statistics and Correlation Matrix, 1917 to 1986

The variables described in this table are defined in Table I and, in more detail, in Section II of the paper. The prefix LN denotes a natural logarithm; for example, $LN(1 + RET)$ is the natural logarithm of one plus the first-day return, RET .

Statistic	RET	$LN(1 + RET)$	$MCAP$	$LNMCAP$	AGE	$LN(1 + AGE)$	BVP	$LNBPV$	$TRACK$	$PROPSOLD$	UW	$PRESTIGE$	RD
Panel A: Descriptive Statistics													
Mean	0.111	0.089	27.48	16.42	36.02	3.09	0.71	-0.56	6.74	0.40	0.89	0.16	0.09
Median	0.060	0.058	12.20	16.32	27.00	3.30	0.61	-0.49	7.00	0.33	1.00	0.00	0.00
Maximum	2.221	1.170	2050	21.44	256.00	5.50	5.24	1.66	30.00	1.00	1.00	1.00	1.00
Minimum	-0.450	-0.598	0.62	13.33	0.00	0.00	-0.62	-4.57	0.00	0.02	0.00	0.00	0.00
Std. Dev.	0.230	0.174	77.28	1.02	34.66	1.18	0.51	0.70	3.94	0.22	0.31	0.37	0.28
Skewness	3.247	1.472	13.69	0.73	1.77	-0.89	2.62	-0.62	-0.06	1.22	-2.48	1.83	2.91
Kurtosis	21.349	8.792	267.81	4.19	7.39	3.60	15.90	4.47	2.99	3.85	7.15	4.33	9.44
No. Obs.	2,553	2,553	2,553	2,553	2,553	2,553	2,553	2,553	2,553	2,553	2,553	2,553	2,553
Panel B: Correlation Matrix													
RET	1.000												
$LN(1 + RET)$	0.976	1.000											
$MCAP$	-0.013	-0.007	1.000										
$LNMCAP$	-0.060	-0.045	0.585	1.000									
AGE	-0.071	-0.049	0.098	0.114	1.000								
$LN(1 + AGE)$	-0.065	-0.028	0.075	0.123	0.810	1.000							
BVP	-0.055	-0.060	-0.050	-0.262	0.165	0.080	1.000						
$LNBPV$	-0.061	-0.070	-0.096	-0.315	0.151	0.052	0.862	1.000					
$TRACK$	-0.034	0.008	-0.009	0.068	0.392	0.590	-0.044	-0.078	1.000				
$PROPSOLD$	-0.180	-0.227	-0.102	-0.257	-0.127	-0.242	0.159	0.223	-0.334	1.000			
UW	-0.084	-0.077	0.059	0.162	0.093	0.156	-0.106	-0.111	0.236	-0.019	1.000		
$PRESTIGE$	-0.027	-0.012	0.286	0.430	0.116	0.132	-0.111	-0.138	0.082	-0.152	0.156	1.000	
RD	0.067	0.069	0.071	0.100	-0.041	-0.012	-0.115	-0.118	-0.043	-0.071	-0.022	0.072	1.000

Table III
Annual Volume, First-Day Returns, Proceeds, and Money on the
Table, 1917 to 2007

First-day returns are the change from the offer price to the final price on the first day of trading, and are equally weighted (EW) and capitalization weighted (CW). Capitalization is defined as the post-IPO market capitalization of voting shares at the offer price. Gross IPO proceeds and money left on the table are in £ millions at end 2007 prices. The sample includes both public offers and placings.

Period	Number of IPOs	EW Mean Returns %	CW Mean Returns %	Median Returns %	Real Gross Proceeds £m	Money on the Table £m
Panel A: WWI to End of WWII						
1917–18	4	5.85	7.20	2.52	11.8	0.9
1919	42	19.35	10.43	3.49	268.0	30.8
1920	63	−0.60	1.02	1.25	413.0	−4.0
1921	3	0.08	0.07	2.09	12.1	0.2
1922	5	1.03	−0.43	−0.76	72.1	−0.8
1923	13	−0.14	5.13	−1.36	140.0	−0.5
1924	8	0.08	−4.72	−1.91	44.1	−3.8
1925	40	6.45	6.22	2.18	420.0	21.0
1926	20	7.75	4.16	3.43	197.0	3.1
1927	38	8.30	−1.57	3.98	455.0	−10.0
1928	74	12.84	20.12	1.43	884.0	126.0
1929	47	15.26	20.41	−1.67	460.0	29.5
1930	6	−0.97	−0.21	−0.05	79.8	0.2
1931	3	2.41	0.10	2.66	38.3	0.9
1932	4	4.15	5.80	5.44	26.6	0.1
1933	12	7.95	7.34	4.58	65.2	3.7
1934	39	13.53	14.46	2.78	546.0	50.3
1935	44	0.66	7.53	0.91	321.0	3.9
1936	73	8.86	8.48	0.62	438.0	24.2
1937	47	−0.27	4.65	−0.14	288.0	14.2
1938	8	1.38	−9.27	1.88	54.5	−5.4
1939	3	−5.90	−4.59	−3.57	5.9	−0.3
1940–45	14	29.43	27.41	27.01	63.5	17.1
Panel B: Post-WWII to the Big Bang						
1946	59	14.79	9.02	10.71	517.0	47.6
1947	96	5.04	3.44	2.30	760.0	26.4
1948	64	0.64	−0.18	1.77	453.0	−2.9
1949	36	2.07	2.56	1.01	251.0	8.7
1950	28	3.54	4.58	3.70	91.5	3.7
1951	38	4.98	3.64	4.78	143.0	3.1
1952	19	7.74	9.26	7.41	64.9	4.1
1953	31	6.87	4.97	8.00	143.0	5.7
1954	40	9.52	2.64	7.92	885.0	10.4
1955	39	13.17	9.73	10.00	846.0	55.3
1956	15	15.53	3.81	1.67	253.0	4.8
1957	23	14.14	11.89	11.54	82.9	7.9
1958	35	14.04	13.12	9.85	134.0	16.0
1959	80	19.20	16.36	13.19	488.0	74.5
1960	93	12.21	10.13	9.38	552.0	51.4

(continued)

Table III—*Continued*

Period	Number of IPOs	EW Mean Returns %	CW Mean Returns %	Median Returns %	Real Gross Proceeds £m	Money on the Table £m
Panel B: Post-WWII to the Big Bang						
1961	58	17.08	16.02	12.35	272.0	45.0
1962	68	17.31	13.88	8.62	555.0	71.4
1963	49	26.02	14.58	18.06	358.0	54.9
1964	65	10.03	6.33	6.00	378.0	22.8
1965	57	7.50	5.43	5.00	260.0	14.1
1966	30	12.31	13.45	8.71	247.0	35.5
1967	26	23.10	23.31	15.28	142.0	32.0
1968	50	13.66	13.48	7.07	379.0	51.4
1969	52	7.02	11.90	1.52	574.0	56.1
1970	52	2.40	3.79	1.30	550.0	21.4
1971	58	13.10	16.31	9.81	749.0	99.2
1972	85	9.78	8.82	5.83	1,370.0	130.0
1973	40	4.81	7.50	4.06	575.0	32.2
1974	1	−24.00	−23.99	−24.00	2.1	−0.5
1975	2	5.21	9.59	5.21	31.6	3.0
1976	5	−9.85	−9.70	−11.67	179.0	−18.5
1977	6	18.01	11.94	15.96	104.0	13.4
1978	10	17.55	17.95	12.63	97.8	16.7
1979	8	22.71	15.53	18.89	154.0	24.5
1980	12	21.40	14.95	19.86	45.7	6.8
1981	44	11.33	−3.01	6.37	361.0	22.2
1982	50	22.55	16.19	10.71	346.0	59.6
1983	69	28.84	23.75	14.29	395.0	78.0
1984	98	16.51	14.62	13.12	830.0	96.1
1985	119	9.06	13.96	5.81	1,860.0	274.0
1986	133	10.00	10.90	7.88	2,750.0	285.0
Panel C: Big Bang to the End of 2007						
1987	108	27.90	27.60	24.25	1,488.5	401.9
1988	107	9.00	5.94	7.37	2,116.1	109.9
1989	22	7.54	14.16	8.32	1,674.7	259.7
1990	9	4.37	2.18	3.33	284.3	3.4
1991	11	7.13	3.21	3.45	1,099.5	31.3
1992	26	7.61	2.92	7.42	2,649.9	80.6
1993	68	12.84	9.27	8.83	3,153.5	283.3
1994	111	7.01	4.19	4.31	7,862.9	353.4
1995	54	14.08	12.43	8.78	3,926.2	484.4
1996	129	15.01	18.09	10.00	5,268.5	896.4
1997	107	10.66	11.77	7.14	5,002.2	737.3
1998	63	13.74	7.99	7.14	8,434.0	1,035.6
1999	63	78.04	20.47	16.54	7,378.3	1,934.3
2000	183	57.93	30.25	10.65	11,551.7	4,050.2
2001	67	13.74	3.05	9.00	6,071.9	305.6
2002	48	7.30	3.16	6.29	2,522.3	39.2
2003	50	15.72	3.75	8.18	3,071.4	86.2
2004	173	14.12	7.86	8.64	5,373.5	416.2
2005	225	12.74	9.47	8.93	7,377.6	635.7
2006	212	12.11	8.46	7.95	11,645.0	909.8
2007	151	9.85	9.16	7.50	9,459.6	674.9

(continued)

Table III—Continued

Period	Number of IPOs	EW Mean Returns %	CW Mean Returns %	Median Returns %	Real Gross Proceeds £m	Money on the Table £m
Panel D: By Decade, 1917 to 2007						
1917–29	357	8.96	9.68	1.89	3,377.1	192.4
1930–39	239	5.43	7.07	0.63	1,863.3	91.8
1940–49	269	7.00	4.64	2.94	2,044.5	96.8
1950–59	348	11.86	9.23	8.70	3,131.3	185.5
1960–69	548	14.01	12.23	8.82	3,717.0	434.6
1970–79	267	8.65	8.87	5.33	3,812.5	321.4
1980–89	762	15.80	13.34	9.61	11,867.0	1,593.2
1990–99	641	18.08	11.32	7.76	45,059.4	5,839.9
2000–07	1,109	19.86	13.05	8.50	57,073.2	7,117.8
Panel E: Complete Data Set						
1917–86	2,553	11.12	10.29	6.00	24,533.4	2,144.3
1917–2007	4,540	14.57	12.05	7.49	131,945.3	15,873.5
Panel F: Major Subperiods						
1917–45	610	8.04	8.97	1.26	5,303.9	301.3
1946–86	1,943	12.09	10.50	7.69	19,229.5	1,843.0
1987–2007	1,987	19.00	12.49	8.70	107,411.9	13,729.2

poor disclosure of placings.²² Excluding the depression years 1930 to 1933, an average of 32 IPOs took place each year between 1919 and 1939. This figure compares favorably with the annual rate of activity up to 1979, other than in the 1960s. By peacetime standards, the seven years immediately following the 1973 to 1974 oil shock had a particularly low number of offerings (see Panel B of Table III). The Dimson, Marsh, and Staunton (2002, 2008) data set shows that the London equity market's collapse during 1973 and 1974, and its 1975 recovery, constituted a quite exceptional period. The inflation-adjusted U.K. equity index (at mid-year) was lower in 1974 to 1976 than in any other year since 1959.

In Panel D of the table, it can be seen that from 8.96% (1917–1929) and 5.43% (in the 1930s) in the interwar decades, the equally weighted mean level of underpricing subsequently rose to 11.86% (in the 1950s) and then 14.01% (in the 1960s). After a narrowing to 8.65% in the 1970s, the equally weighted mean level of underpricing averaged 15.80% in the 1980s. Reflecting the growth of London's Alternative Investment Market, which facilitated numerous IPOs by very small companies, there were even higher average levels of underpricing in the 1990s and 2000s. The median underpricing reveals the same contrast

²² We estimate that during the interwar years, ordinary share IPOs accounted for close to half of all offerings, preference share IPOs around a third, and the rest were combined ordinary and preference IPOs. As for placings, we exclude 308 interwar IPOs because the placing price was not disclosed in the prospectus.

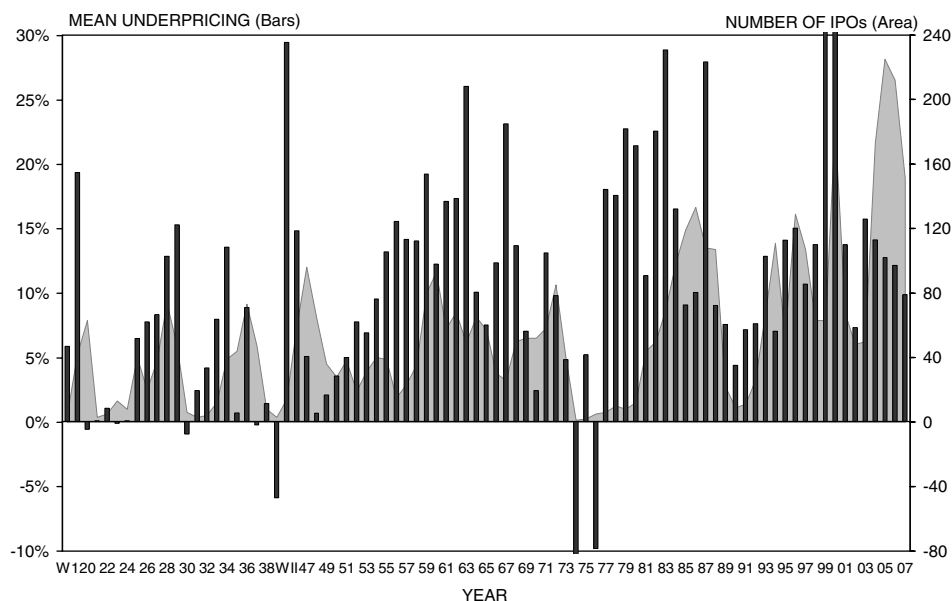


Figure 2. Time series of underpricing (LHS bars) and volume (RHS area), 1917 to 2007. Underpricing is defined as first-day percentage returns, relative to the issue price, and volume is defined as the number of IPOs in a given year. The annual underpricing averages are equally weighted intrayear means except WWI (1917 to 1918) and WWII (1940 to 1945). There are no observations for 1915 and 1916. Both public offers and placings are included. The estimates of underpricing and volume are based on the data set for 1917 to 1986 compiled for this study, and on secondary sources for 1987 to 2007 (see Section III). The bars depicting underpricing are truncated for 1974 (−24%, based on one IPO), 1999 (+78%), and 2000 (+58%).

between the lower level of underpricing in the interwar decades, and a higher level after WWII.

Panel E of Table III summarizes, for the 2,553 IPOs between 1917 and 1986, the mean and median first-day returns, and gross IPO proceeds, and money left on the table in end-of-2007 purchasing power. In total, some £2 billion was left on the table for this IPO sample. Equally weighted mean underpricing was 11.12% over the entire period. The lower row of Panel E shows that the underpricing story is essentially the same over the entire 91 years from 1917 to 2007. Over this longer interval, equally weighted mean underpricing, capitalization weighted mean underpricing, and the median level of underpricing are all larger than the 1917 to 1986 estimates (reflecting the higher initial premia on AIM issues). Making no distinction between public offers and placings, Panel F shows that the 610 IPOs over the period to 1945 were underpriced by an average of 8.04%, whereas after 1945, a further 1,943 offerings (all pre-Big Bang) were underpriced by an average 12.09%.

Figure 2 graphs the annual time series of mean first-day returns and the number of IPOs in each year. There are two striking features to this chart: the

Table IV
Mean First-Day Returns and IPO Volume by Issue Method,
1917 to 1986

Mean returns from the offer price to the first day of trading are computed for public offers and placings. The table reports equally weighted mean returns for IPOs within various subperiods. The table also reports the breakdown between the number of public offers and the number of placings during each subperiod.

Period	Public Offers		Placings	
	Mean Return	Number	Mean Return	Number
Panel A: Individual Decades				
1917–29	5.65%	315 (88%)	33.80%	42 (12%)
1930–39	0.87%	200 (84%)	28.82%	39 (16%)
1940–49	4.73%	137 (51%)	9.36%	132 (49%)
1950–59	10.32%	91 (26%)	12.41%	257 (74%)
1960–69	11.57%	336 (61%)	17.88%	212 (39%)
1970–79	7.87%	219 (82%)	12.25%	48 (18%)
1980–86	8.95%	159 (30%)	17.69%	366 (70%)
Panel B: From WWI to the Big Bang				
1917–86	7.26%	1,457 (57%)	16.26%	1,096 (43%)
Panel C: Major Subperiods				
1917–45	3.80%	515 (84%)	31.11%	95 (16%)
1946–86	9.15%	942 (48%)	14.85%	1,001 (52%)

cycle of “hot” and “cold” markets in underpricing, and the rise in the average level of underpricing since the mid-1950s. The latter is the primary focus of this paper. The recent story of IPO underpricing from the 1980s onward has been told by Loughran and Ritter (2004) and others, who have investigated the changing incentives for issuers, investors, and intermediaries (see Section II). Our emphasis is on the interval from WWII to the Big Bang deregulation in 1986, and on the contrast with the interwar period.

Given their lack of transparency and their susceptibility to manipulation, there was a marked tendency for placings to be more underpriced than public offers, as can be seen in Table IV. After 1945, reflecting the LSE’s attempts to regulate the placing method more strictly, the underpricing of placings narrowed. However, this pattern was not replicated among public offers, the underpricing of which widened after 1945. As can be seen in Panel C of the table, up to 1945 public offers were underpriced by an average of 3.80%, whereas after WWII they were underpriced by an average of 9.15%.

B. Univariate Partitioning

Both this and the next section review the ability of the changing risk composition of IPOs to explain observed shifts in underpricing. The breakpoint of

1945 used in this section and the next is determined exogenously by the discussion of developments in investor protection (Section I.B) and underwriting (Section I.C).²³ In this section, we examine the univariate relationships between underpricing and firm size (*MCAP*), firm age (*AGE*), book value to offer price (*BVP*), length of profit record (*TRACK*), and the proportion of a firm's voting equity sold at the IPO (*PROPSOLD*). As noted in Section II, there is a general presumption that more mature and more stable firms should experience less underpricing, which is typically explained in the literature by the rationale that they are easier to value, and hence investors do not demand price protection against valuation errors.

In Table V, IPOs are sorted each period into quartiles, and we estimate the equally weighted mean first-day return for each quartile. If, for example, underpricing varies negatively with market capitalization, as hypothesized, there should be a monotonic decrease in underpricing as capitalization increases through the quartiles, other things being equal. For an integer variable like *AGE*, quartiles can have differing numbers of constituents. In the case of *PROPSOLD*, the breaks are struck after excluding those firms that, as a consequence of restructuring, had poor disclosure regarding the proportion of their equity sold at IPO.²⁴

Table V provides evidence in favor of the hypothesized univariate relationships. Looking across time, the clearest support for the hypothesized relationships is found in the 1946 to 1986 period. Underpricing decreases systematically, as firm size (*MCAP*), *AGE*, book value to offer price (*BVP*), and *PROPSOLD* increase. This pattern is less reliable during the 1917–1945 period, when only *AGE* and *PROPSOLD* display similar relationships, *MCAP* displays a weaker (and nonmonotonic) relationship, and *BVP* and *TRACK* show no relationship with underpricing. Nevertheless, as the IPO boom of the late 1990s highlighted, underpricing is not determined exclusively by the need to entice investors to subscribe to IPOs, since hot IPO markets can be accompanied by severe queuing and harsh rationing of IPO allocations. In addition to market pressures, managerial motivations are also likely to be relevant as determinants of IPO prices, an observation that is further supported by the large regression coefficients on *PROPSOLD* that we report in the following section.

C. Regression Results

The results from running OLS regressions of the underpricing model (2) are summarized in Table VI. As described in Section II, all regressions use a set of dummy variables for issue year (*YEAR*) and industry sector (*SECTOR*), and

²³ The choice of 1945 rather than 1948 reflects the timing of the Cohen Committee Report making recommendations leading to the 1948 Act, the anticipation of the Act's financial disclosure provisions by the accounting profession, and the establishment of the IHA at the end of 1945. The use of 1948 does not affect the main findings reported below.

²⁴ See footnote 13. In the period 1917–1945, the 85 IPOs with *PROPSOLD* = 100% display equally weighted mean underpricing of 7.29%.

Table V
Univariate Analysis of First-Day Returns by IPO Characteristics

The IPO characteristics described in this table are defined in Table I. For each characteristic, IPOs are ranked and assigned to quartiles. Within each quartile, the mean value of the characteristic and the mean first-day return are equally weighted averages for the quartile's constituents. In Panels B and C, the 54 missing *AGE* and 23 missing *BVP* observations are infilled with their equally weighted means. In Panel E, the averages omit 85 interwar IPOs that sold all their voting equity but where insiders probably subscribed to the IPO (see footnote 13); these omitted IPOs were underpriced on average by 7.29%.

Quartile	Quartile Means 1917–45			Quartile Means 1946–86		
	Attribute	Return	No of Obs	Attribute	Return	No of Obs
Panel A: IPOs Ranked by Firm Size in £millions (<i>MCAP</i>)						
1	3.3	13.39%	153	5.2	15.17%	486
2	6.4	4.68%	152	10.6	12.44%	486
3	11.0	5.44%	152	19.8	10.67%	486
4	44.7	8.74%	153	89.3	10.06%	485
All	16.3	8.03%	610	31.2	12.09%	1,943
Panel B: IPOs Ranked by Firm Age in Years (<i>AGE</i>)						
1	0.2	10.39%	133	8.2	16.84%	472
2	6.3	8.53%	173	21.2	12.40%	506
3	24.4	7.21%	184	41.2	10.44%	485
4	60.6	5.95%	120	90.6	8.74%	480
All	22.8	8.03%	610	40.2	12.09%	1,943
Panel C: IPOs Ranked by Ratio of Book Value to Offer Price (<i>BVP</i>)						
1	0.44	7.43%	153	0.22	14.26%	486
2	0.78	8.24%	152	0.43	13.16%	486
3	0.94	12.30%	152	0.66	10.64%	486
4	1.51	4.19%	153	1.27	10.28%	485
All	0.92	8.03%	610	0.65	12.09%	1,943
Panel D: IPOs Ranked by Length of Profit Record in Years (<i>TRACK</i>)						
1	0.0	8.72%	158	4.3	16.44%	488
2	0.0	8.81%	153	7.2	13.09%	486
3	2.8	7.06%	149	10.0	11.13%	488
4	6.8	7.48%	150	10.9	7.64%	481
All	2.4	8.03%	610	8.1	12.09%	1,943
Panel E: IPOs Ranked by Proportion of Voting Equity Sold (<i>PROPSOLD</i>)						
1	0.26	17.85%	132	0.18	16.08%	471
2	0.48	11.31%	131	0.26	13.51%	485
3	0.66	1.91%	131	0.34	11.33%	486
4	0.82	1.45%	131	0.52	7.69%	501
All	0.55	8.15%	525	0.33	12.09%	1,943

Table VI
OLS Regressions of First-Day Returns, 1917 to 1986

The dependent variable, *RET*, is the first-day IPO return, measured as a decimal. Other variables are described in Table I. All regressions are described in the text as model (2) and include a full set of *YEAR* dummies, industry *SECTOR* dummies, and a lagged market return. In Panels B to D, we incorporate all variables noted in the table, plus a *RESTRUCTURE* dummy for pre-IPO reorganizations that obscure prospectus data, an *AUDIT* dummy for whether the asset valuation had been subject to an independent audit, and (in Panel B) a placing method dummy. Estimation is by OLS and standard errors are calculated using White's (1980) heteroskedasticity-consistent method. *p*-values are in parentheses. Statistical significance of coefficients at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Reg	Period	<i>LNMCAP</i>	<i>LN(1 + AGE)</i>	<i>LNBPV</i>	<i>TRACK</i>	<i>PROPSOLD</i>	<i>UW</i>	<i>PRESTIGE</i>	<i>RD</i>	<i>N</i>	<i>AdjR</i> ²
Panel A: All IPOs											
(1)	All	-0.017*** (0.003)								2,553	0.106
(2)	All		-0.0151*** (0.006)							2,553	0.106
(3)	All			-0.016** (0.027)						2,553	0.104
(4)	All				-0.005*** (0.004)					2,553	0.106
(5)	All					-0.216*** (0.000)				2,553	0.127
(6)	All						-0.074*** (0.000)			2,553	0.110
(7)	All							-0.032*** (0.001)		2,553	0.106
(8)	All								0.038** (0.038)	2,553	0.104

(continued)

Table VI—Continued

Reg	Period	LNMCAP	LN(1 + AGE)	LNBPV	TRACK	PROPSOLD	UW	PRESTIGE	RD	N	AdjR ²
Panel B: All IPOs											
(9)	All	-0.014** (0.034)	-0.010* (0.098)	-0.015** (0.047)	-0.004** (0.036)	-0.245*** (0.000)	-0.041** (0.045)	-0.009 (0.355)	0.041** (0.024)	2,553	0.149
(10)	1917–45	-0.021 (0.148)	-0.001 (0.916)	-0.007 (0.734)	0.005 (0.180)	-0.280*** (0.000)	-0.074* (0.052)	-0.045 (0.451)	0.115* (0.073)	610	0.157
(11)	1946–86	-0.018** (0.017)	-0.016** (0.022)	-0.014* (0.055)	-0.007*** (0.001)	-0.185*** (0.000)	0.001 (0.956)	-0.009 (0.316)	0.030* (0.095)	1,943	0.173
Panel C: Offers for Sale											
(12)	All	-0.010 (0.188)	-0.005 (0.546)	-0.007 (0.404)	-0.005** (0.019)	-0.223*** (0.000)	-0.072* (0.056)	-0.002 (0.869)	0.068** (0.027)	1,457	0.101
(13)	1917–45	-0.003 (0.824)	0.005 (0.636)	0.015 (0.356)	0.002 (0.486)	-0.240*** (0.002)	-0.078* (0.053)	-0.049 (0.521)	0.124* (0.075)	515	0.043
(14)	1946–86	-0.011 (0.224)	-0.012 (0.169)	-0.011 (0.299)	-0.011*** (0.001)	-0.187*** (0.000)	-0.056 (0.601)	0.009 (0.483)	0.039 (0.193)	942	0.156
Panel D: Placings											
(15)	All	-0.050*** (0.000)	-0.025** (0.021)	-0.026** (0.021)	-0.002 (0.514)	-0.252*** (0.001)	0.025 (0.269)	-0.036** (0.022)	0.035 (0.102)	1,096	0.217
(16)	1917–45	-0.145*** (0.007)	-0.057 (0.278)	-0.058 (0.469)	0.024 (0.321)	-0.359** (0.048)	0.123 (0.303)	0.167 (0.539)	-0.104 (0.603)	95	0.202
(17)	1946–86	-0.035** (0.014)	-0.018* (0.084)	-0.021** (0.050)	-0.005 (0.144)	-0.213*** (0.000)	0.016 (0.463)	-0.042*** (0.007)	0.033 (0.112)	1,001	0.154

a lagged market return variable (*MRET*) measured over 1 month prior to the first day of trading.²⁵ Panel A reports regressions with one control variable included at a time, with highly significant coefficients being obtained on *LNMCA*P, *LN*(1 + *AGE*), *TRACK*, *UW*, *PRESTIGE*, and *PROPSOLD*, while *LNBVP* and *RD* are significant at the 5% level. *AUDIT* has no statistical significance either univariately or multivariately in the regressions that follow, and we do not report it in Table VI.

Panel B reports the results from estimating a multiple regression using all variables across the entire 1917 to 1986 sample period. All variables are of the expected sign. The proportion of voting equity sold in the offering (*PROPSOLD*) is statistically significant at the 1% level and five other issue attributes, *LNMCA*P, *LNBVP*, *TRACK*, *UW*, and *RD*, are significant at the 5% level; *LN*(1 + *AGE*) is significant at the 10% level. The *PROPSOLD* coefficient is substantial, as may be illustrated by comparing an IPO in which nearly all the outstanding shares are sold with an IPO that has a negligible proportion sold. The coefficient on *PROPSOLD* indicates that, other things equal, underpricing for the former would be reduced by 24.5%, yielding substantially higher gross proceeds, as predicted by the realignment of incentives hypothesis. Over the entire sample period, firm age (*LN*(1 + *AGE*)), firm valuation (*LNBVP*), R&D-intensity (*RD*), and *TRACK* are of limited economic significance. In the latter case, an IPO disclosing an additional decade of profits would reduce underpricing by a modest 4%.

Panel B also reports the results from estimating the model over the subperiods 1917 to 1945 and 1946 to 1986. The most powerful results are obtained post-1945 (regression 11), when the coefficients are of the predicted sign and, except for *UW* and *PRESTIGE*, are statistically significant. These results suggest that the improved prospectus disclosure may have had a beneficial impact insofar as underpricing was now varying with levels of disclosure, as proxied by the length of the profit record. To a lesser extent, underpricing was varying also with the reliability of net asset values disclosed, as well as firm risk measures, age, and size. In addition, we test for the marginal effect of prospectus disclosure on underpricing by including alternative explanatory variables, namely, a dummy variable indicating whether the prospectus disclosed an independently verified asset valuation (*AUDIT*), mentioned above, and a simple count of the number of balance sheet items. However, these results are, disappointingly, not significant.

²⁵ Estimated over 1917 to 1986, the coefficient on the 1-month prior return is 0.816 ($p = 0.000$). This is marginally statistically different from one ($p = 0.0927$), which we attribute to the lack of a daily index before January 1930, as explained in footnote 20. The coefficient over the period 1930 to 1986 is 0.882 ($p = 0.0000$), which is not statistically different from one ($p = 0.2758$). For the 1917 to 1929 period, for which daily data are unavailable, the coefficient is -0.006 ($p = 0.9916$). We also measure *MRET* over 3 months, with a coefficient of 0.669 ($p = 0.000$). In addition, we experiment with stock market volatility estimated over the 21 business days prior to the first day of trading. Based on data commencing in January 1930, volatility does not enter significantly into regressions (2) and (3), indicating that underpricing did not fluctuate systematically with overall equity market uncertainty.

As regards the impact of underwriting, in the 1917–1945 period the coefficient on *UW* (regression 10) indicates that the benefit of simply having an IPO underwritten was a considerable 7.4%; however, this benefit disappeared after 1945 (regression 11), as virtually all IPOs were underwritten. The coefficient on *PRESTIGE*, although not statistically significant, indicates that the hiring of a reputable bank as underwriter was of modest economic benefit in the earlier period (regression 10) but had no discernible economic impact on underpricing in the later period (regression 11). Hence, while certification in the form of simply having an IPO underwritten ameliorated underpricing, the added benefit from hiring a prestigious bank apparently did not.

We reestimate the regressions in Panel B including terms interacting the placing dummy with the explanatory variables. The results suggest that firm size, age, track record, and underwriter reputation have different marginal effects on public offers and placings in the interwar period.²⁶ Consequently, Panels C and D in Table VI report the regressions for the whole period and the two subperiods for public offers and placings, respectively. In the rest of this paper, we focus the discussion upon public offers.²⁷

D. Comparison of Pre- and Post-1945 Periods

We can now return to the main question of the behavior of IPO underpricing over time. Controlling for changing risk composition, sector risk, and equity market conditions as well as the influence of underwriter reputation and investor protection, we estimate the coefficients on the *YEAR* dummy variables using a regression similar to model (2) for the 1,457 public offers. The only difference is that, with the exception of *YEAR*, which is defined as before, all other explanatory variables are demeaned in order to assist economic interpretation of the *YEAR* coefficients. In model (2), each *YEAR* coefficient represents the level of underpricing experienced in a given year by an IPO with characteristics in line with average values for the sample. From a simple regression of these *YEAR* coefficients on a constant plus a dummy variable for each post-1945 year, the difference (+9.17%) between the mean value for the 1917–1945 period (+0.22%) and that for 1946–1986 period (+9.40%) is highly statistically significant with a *p*-value of 0.0000.²⁸ In Figure 3, we graph the *YEAR* dummy coefficients for public offers, accompanied by the means of these coefficients over 1917 to 1945 and 1946 to 1986.

If the coefficients are weighted by the number of public offers in each year, the weighted means of the *YEAR* dummy coefficients in the same two intervals

²⁶ In an *F*-test, we could not accept the null hypothesis that the coefficients on the interactions between the placing dummy and *LNMCAP*, *LN(1 + AGE)*, *LNBPV*, *TRACK*, *PROPSOLD*, *UW*, *PRESTIGE*, and *RD* in (2) were all equal to zero for both the whole period (*p*-value = 0.0000) and the two subperiods. We thank Mahendrarajah Nimalendran for this suggestion.

²⁷ An *F*-test suggests that when applying model (3) in the following section to public offers only, we can accept the null that the slopes of the explanatory variables did not differ across the periods 1917 to 1945 and 1946 to 1986 (*p*-value = 0.2730).

²⁸ The residuals from this simple regression exhibit no serial correlation under standard tests.

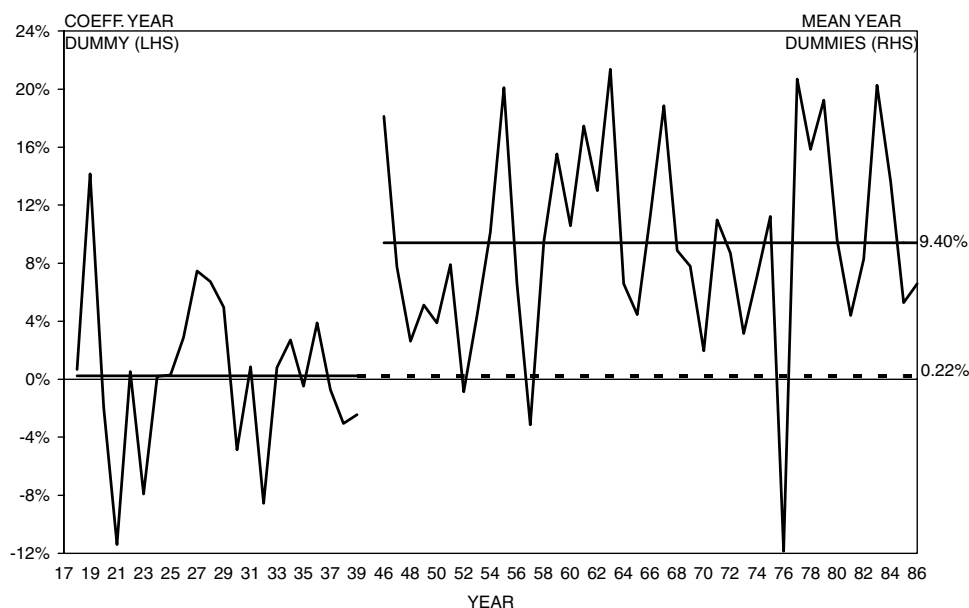


Figure 3. YEAR coefficients in regression of underpricing on control variables, 1917 to 1986. We show the coefficients on the YEAR dummies relating to public offers in a regression similar to model (2) except that the explanatory variables are demeaned (see text). The horizontal lines show the means of the YEAR dummies over the 1917 to 1945 and 1946 to 1986 intervals, namely, 0.22% and 9.40%, respectively. There were no public offers from 1940 to 1945 and in 1974.

are +2.88% and +9.63%, respectively: an increase of 6.75%.²⁹ In a further test of this upward shift in underpricing of public offers, we replace the individual year dummies with two dummy variables for IPOs occurring during 1917–1945 (*UPTO1945*) and 1946–1986 (*AFTER1945*). The regression model is as follows:

$$\begin{aligned}
 RET = & b_1 \cdot LNMCAP + b_2 \cdot LN(1 + AGE) + b_3 \cdot LNBVP + b_4 \cdot TRACK \\
 & + b_5 \cdot AUDIT + b_6 \cdot PROPSOLD + b_7 \cdot UW + b_8 \cdot PRESTIGE + b_9 \cdot RD \\
 & + b_{10} \cdot SECTOR + b_{11} \cdot RESTRUCTURE + b_{12} \cdot MRET + b_{13} \cdot USM \\
 & + b_{14} \cdot UPTO1945 + b_{15} \cdot AFTER1945 + \varepsilon.
 \end{aligned} \tag{3}$$

Once again, all explanatory variables other than the two dummy variables of interest, *UPTO1945* and *AFTER1945*, are demeaned. The 7.93% difference in

²⁹ In contrast to public offers, the evidence from model (2) when estimated using only placings points to a substantial decrease in underpricing across the two periods. The decrease in equally weighted mean underpricing is 10.08% ($p = 0.0795$), confirming the sharp fall exhibited by equally weighted first-day returns (Table IV, Panel C). Assuming the interwar sample of only 95 placings is representative of the underpricing experience of the larger population of IPOs using this method, and given the relative lack of transparency and fairness they exhibited pre-1945 (Section I.B), this result is not surprising.

the coefficients on *UPTO1945* (+2.10%) and *AFTER1945* (+10.03%) represents the estimated increase in the underpricing of public offers. We carry out a standard Wald test of the null hypothesis that restricting these two coefficients to equality, $b_{14} = b_{15}$, is valid, and the null is rejected with a p -value of 0.0001.³⁰

Lastly, the increase in underpricing of public offers is confirmed by comparing the median of the *YEAR* coefficients in the 1917–1945 period (+0.42%) and the post-1945 period (8.79%). Median yearly underpricing rose by 8.37%, which is significant at the $p = 0.0000$ level using a standard Wilcoxon-signed rank test.³¹

To summarize, the increased underpricing of LSE offers is confirmed by analysis of individual year dummies, 1917–1945 and post-1945 period dummies, and medians of the annual coefficients. The post-WWII increase in the underpricing of public offers is in all tests statistically highly significant.

E. Robustness

We conclude this section by examining the robustness of our findings, which are summarized in Table VII. Our base case discussed above is restated in row 1. The increase in underpricing is measured in three ways: the difference in equally weighted means of the *YEAR* dummy variable coefficients from model (2) over the 1917 to 1945 and 1946 to 1986 periods, the difference between the two period dummy coefficients in model (3), and the difference in the median *YEAR* coefficient for each period.

We start with our definition of underpricing, which is measured by first-day percentage returns. If, instead, we specify the dependent variable in natural logarithmic form, $LN(1 + RET)$, the magnitudes of underpricing are smaller, since the log of a positive number has a lower value than the unlogged number. Consequently, underpricing increases by a smaller amount, on average by 7.65% using logarithmic returns, rather than by 9.17% as in the base case. However, the increase in underpricing from 1917 to 1945 to the post-1945 period, measured using logarithmic returns, is undiminished in its level of statistical significance (row 2).

We also examine the interval over which we measure underpricing in equation (1). As an alternative to the first day of trading, we re-estimate underpricing in terms of partial first-month premia, defined as the return to the end of the first trading month, measured relative to the offer price. Given the lack of a daily market index prior to January 1930, we are only able to adjust returns for IPOs after this date. The partial first-month premia of public offers

³⁰ The decrease in the period dummies is 16.82% ($p = 0.0000$) from estimating model (3) on placings alone.

³¹ For completeness, we also report the median and market capitalization weighted mean of the individual first-day returns. Median first-day returns rose from 0.00% (1917–1945) to +5.16% (post-1945); a Wilcoxon signed rank test rejects the null hypothesis of the equality of these medians with a p -value of 0.0000. Capitalization weighted mean first-day returns, where capitalization is defined as the post-IPO market capitalization of all voting shares at the offer price, rose from +5.85% (1917–1945) to +9.62% (post-1945).

Table VII
Robustness Tests of Changes in Underpricing of Public
Offers after 1945

We report three measures of the change in underpricing from 1917 to 1945 and 1946 to 1986: the difference in the equally weighted (EW) means for each subperiod of the *YEAR* dummy variable coefficients in model (2), the difference in the median of the *YEAR* dummy variable coefficients in model (2) for each subperiod, and the difference between the coefficients of the *UPTO1945* and *AFTER1945* dummy variables in model (3). All differences are measured in percentages. Statistical significance at the 5% and 1% level is indicated by ** and *** respectively.

Method for Measuring <i>YEAR</i> or Period Dummies in Regressions (2) and (3)	Difference between 1917–45 and 1946–86 Year Dummies		
	EW Mean	Median	Period Dummies
1. Base case, using nonlogarithmic underpricing	9.17***	8.37***	7.93***
2. Use logarithmic measure of underpricing	7.65***	6.37***	6.72***
3. Measure underpricing to end of 1 st trading month	7.27***	8.05***	7.32**
4. As row 3, but incorporating a dummy for Ford	8.75***	8.12***	8.57***
5. Extending sample to include “package” IPOs	8.35***	7.60***	7.05***
6. Include dummy variable for call feature	6.54***	5.21***	6.38***
7. Switch breakpoint from 1945 to 1948	8.05***	8.21***	4.36***
8. As row 7, omitting war periods 1917–19 & 1939–46	7.71***	6.24***	5.70***
9. Omit IPOs with missing data that were infilled	8.91***	8.77***	7.89***
10. Winsorize dependent and independent variables	7.57***	6.50***	6.48***

averaged 2.87% and 10.52% over the 1917 to 1945 and 1946 to 1986 periods, respectively, and are not statistically significantly different from those estimated using prices on the first day of trading. Both the inability to adjust pre-1930 premia for daily market movements and the increased variance of these estimates reduces the economic and statistical significance of the increase in underpricing (row 3). Controlling for the Ford Motor IPO, which rose a massive 383% in the 11 days from the end of the first trading day to month end,³² by the inclusion of a dummy variable, shifts the estimated underpricing increase in the case of the period dummies, for example, from 7.32% (row 3, p -value = 0.0115) to 8.57% (row 4, p -value = 0.0011).

We scrutinize the impact of sample eligibility (row 5). Our regressions exclude 148 IPOs of ordinary shares packaged with voting preference shares, all of which occurred in the interwar years. The ordinary share components of these offers were heavily underpriced but the preference share component was, on average, overpriced. The initial return of the package is defined as the return of each component on a fully paid basis, weighted by the fixed ratio indicated in the prospectus for which shares must be applied. These IPOs displayed equally weighted average underpricing of 5.75%. Including them would not change our finding that IPO underpricing was higher in the post-WWII era than in the period up to 1945.

Our sample also omits introductions and transfers of listing, since these new lists are unaccompanied by a sale of new or existing shares. Derrien and Kecskés

³² In contrast, the largest partial first-month increase among post-WWII IPOs is the 158% recorded by Amalgamated Securities in October 1959.

(2007) note that underpricing is lower for new issues that already had a prior trading history. Introductions and transfers from a provincial exchange to the London market were commonplace during the interwar period, and if they were included in our sample, measured underpricing would have been even smaller in the 1917 to 1945 period. If our sample were extended to include introductions and transfers, it follows that the jump in underpricing after 1945 would be even more pronounced.

Since they were important to interwar IPOs, we estimated the impact of call features by including a dummy variable for each of the 267 partially paid IPOs with dated call features and the 42 IPOs with undated call features (see footnote 17).³³ Compared to our base case (row 1), the increase in underpricing was smaller but still ranged between 5.21% and 6.54% (row 6).

We additionally conduct sensitivity analysis of the 1945 breakpoint and the impact of wartime capital market controls. We have argued that 1945 represented the most important breakpoint over the period from WWI to the Big Bang in 1986. Reflecting the element of uncertainty regarding the precise timing of regulatory changes leading up to the 1948 Companies Act, we experiment with 1948 as an alternative breakpoint.³⁴ Compared to the base case, this shift of breakpoint lowers the economic significance, particularly in the case of the period dummies (+4.36%, p -value = 0.0024), but not the statistical significance of our results (row 7). However, not only do we believe 1945 to be the more justifiable breakpoint (see footnote 23), the choice of 1948 pushes the first year after the end of war into the earlier period. Note that the immediate postwar years, 1919 and 1946, exhibited strong underpricing following the removal of wartime controls on IPOs. Excluding IPOs in these two years as well as during wartime (row 8) reveals an increase in underpricing, as indicated by the period dummies, of 5.70% (p -value = 0.0034).

We also present sensitivity analysis in relation to missing and extreme observations. For book-value-to-price (*BVP*), underwriter reputation, and R&D activity, 0.68% of observations were missing and infilled with each variable's mean, while 0.20% of *BVP* observations were winsorized (see footnote 19). If the missing observations are excluded, the rise in underpricing (row 9) is very similar to the base case. To quantify the impact of outliers, we winsorize both the dependent and the continuous independent variables by trimming outlying observations to no more than 2.5 standard deviations from their respective mean values (row 10). The increase in equally weighted means across the two periods is still a highly statistically significant +7.57%.³⁵

³³ The remaining 10 partially paid and 2 undated IPOs were placings.

³⁴ Since there were no public offers between 1940 and 1945, this prevented experimenting with 1939 as a breakpoint.

³⁵ A final opportunity for robustness testing is the impact of underwriter *PRESTIGE* on underpricing. After WWII, this is potentially endogenous since, as Habib and Ljungqvist (2001) note, there is an incentive for a firm susceptible to underpricing to hire a prestigious underwriter. Durbin-Wu-Hausman tests indicate that two-stage least squares estimation, which is the standard method for addressing endogeneity, is infeasible when employing the few instrumental variables available to us.

Our principal finding is that underpricing of public offers was lower before than after 1945. Robustness checks show that this result is not attributable to our specification of the measure of underpricing, choice of control variables, sample definition, methods of weighting each observation, or the impact of outliers.

V. Discussion

As the rise in the annual underpricing dummies indicates, any benefit from improved post-WWII regulation and disclosure appears to have been overwhelmed by other influences. What might they have been? We argue in this section that, after the war, market developments eroded the trust between investors, issuers, and sponsors that had been prevalent when markets were more local. Consistent with this trend, London-based investment banks became more powerful, managers faced new incentives as markets became institutionalized, and the winner's curse became more prevalent in the IPO market.

Building on the analysis in Section I.D, our first hypothesis is that IPO underpricing is mitigated by trust. Hong, Kubik, and Stein (2004) and others emphasize the linkage between social interaction and stock market participation, and contribute toward explaining the preference of investors to invest locally. It follows that trust between issuers, intermediaries, and investors should be important when floating an IPO. Lavington (1921) was the first to advance the hypothesis that, early in the twentieth century, there were greater levels of trust between local issuing firms, local issuing houses, and local investors in the vicinity of the Provincial Stock Exchanges (PSEs). Thereafter, these local exchanges, led by the largest PSEs, increasingly fell in line with LSE regulatory practice and lost business to London.

Five PSEs were located in major cities in England (Birmingham, Liverpool, and Manchester) or Scotland (Edinburgh and Glasgow). However, there were small exchanges in Bradford, Bristol, Cardiff, Dundee, Huddersfield, Leeds, Newcastle, Nottingham, and Sheffield, all of which hosted at least one IPO that was offered simultaneously on the LSE. These offerings were by local issuers whose local sponsors offered shares to local investors. There were 29 of these IPOs, and they were 4.5% less underpriced than those listed on the five major provincial exchanges and London ($p = 0.0147$). Consistent with a story based on trust, the provincial firms listing on the smallest PSEs benefited from the close ties within a community. Further examination of the impact of trust on IPO pricing must await a larger sample of Provincial offerings. However, the importance of trust in stock market transactions is emphasized by a wide range of writers subsequent to Lavington (1921), including Michie (1999), La Porta et al. (1997, 1998), and Hong et al. (2004). The post-WWII increase in underpricing is consistent with reduced levels of trust between participants in the IPO market. While some of the decline in trust may explicitly be linked to the larger and more centralized market that evolved in London, this pattern is intertwined with the growing power of London-based banks, the emerging importance of institutional investors, and an exacerbated winner's curse.

The failure of prestigious banks to moderate post-WWII underpricing suggests a second hypothesis, that investment banks exerted market power in

IPOs after 1945. In at least two episodes, issue methods emerged that mitigated underpricing. In the interwar period, around 50% of IPOs were issued on a partially paid basis, which appeared to reduce money left on the table, as compared to fully paid issues (see Section IV.E above); and in the 1960s offers for sale by tender also reduced money left on the table, as compared to fixed price offers (Merrett et al. (1967), Dimson (1979)). In pre-Big Bang Britain, banks, together with institutional investors, stuck with the traditional fixed price method and consequently were able to benefit by underpricing IPOs more (Chambers (2009)). The demise of issue methods that alleviated underpricing is consistent with market power being greater for banks than for issuing firms and their selling shareholders. This is similar to Chen and Ritter's (2000) claim that, in the 1990s, U.S. banks were able to set direct IPO costs above the competitive level.

Finally, the post-WWII growth of institutional equity investment might give credence to the Brennan and Franks (1997) view that nonselling managers of issuing firms used underpricing to spread ownership widely, thereby retaining control of the firm while obtaining the benefits of a listing. In the interwar years this strategy was unnecessary because, as discussed in Section I.E, there was no market for corporate control in the United Kingdom. However, with the passage of the 1948 Companies Act, company accounts became more reliable and transparent, and in the following decade the threat of hostile takeovers materialized, and underpricing may have become more severe in response. Testing their hypothesis on a small sample of 43 U.K. IPOs between 1986 and 1989, Brennan and Franks conclude that the propensity to be acquired was lower than for seasoned firms, and that 10% additional underpricing reduced the size of block shareholdings by 7.7%. The former result, which was not subjected to any statistical tests, could be overturned in post-IPO trading, and its economic significance is open to dispute. Based on 2,622 U.S. IPOs between 1990 and 1998, Smart and Zutter (2003) uncover a relationship only one-tenth of the economic significance of the U.K. case.

The same phenomenon of rising institutional equity ownership post-WWII also led to greater investor heterogeneity, compared to the interwar period, and thereby worsened the winner's curse. While Rock's (1986) model of the winner's curse is supported by 1980s U.K. evidence (Levis (1990)), tests require information on the level of IPO subscriptions and the subsequent share allocations by size of investor, which are typically available only for the modern period. One crude proxy for the extent of the rise of the winner's curse over time is the percentage of equities owned by informed investors, deemed to be insurance companies and pension funds. We estimate that their combined share increased from 1.8% in 1919 to 8% in 1945, and then to almost 50% by the time of the Big Bang.³⁶ Using public offers, we regress the *YEAR* dummy variable coefficients from our base case in model (2) on this institutional ownership variable.

³⁶ These figures are estimated from a quinquennial time series of the allocation made to ordinary shares by U.K. insurance companies out of total assets between 1913 and 1962 (Sheppard (1971) spliced with 6-year observations of share ownership by insurance companies and pension funds between 1963 and 1991 (Central Statistical Office (1995)). We assume that pension funds had very little invested in ordinary shares prior to 1945.

The coefficient on the latter is statistically significant ($p = 0.0047$) and implies that every 10% increase in institutional ownership post-1945 increased underpricing of offers by 2%.³⁷ Repeating the exercise using annual median first-day returns regressed on the same institutional ownership variable and the annual time series of median values of *MCAP*, *AGE*, *BVP*, *TRACK*, and *PROPSOLD* suggests a more modest 1.2% increase in underpricing for every 10% increase in institutional equity holdings ($p = 0.0741$). Although this measure could be capturing the influence of some omitted variable, it is at least consistent with an exacerbated winner's curse in the market for post-WWII IPOs.

VI. Conclusion

In summary, the interwar IPO market operated under the principle of caveat emptor. Improvements in investor protection were crowded into the period after 1945, as was the entry of underwriters of high reputation. Despite this progress, our study of U.K. IPOs shows that underpricing of public offers rose markedly from 3.80% in the pre-WWII period to 9.15% in the post-WWII period ending in 1986. The increase in underpricing is not explained by the composition of firms that undertake an IPO. We suggest several intertwined explanations for this puzzle, led by the reduced level of trust between investors, issuers, and sponsors after the Second World War. Consistent with this interpretation, we observe investment banks' reluctance to retain issue methods that mitigate underpricing, the impact of institutionalization of the equity market, and a winner's curse problem that intensified after WWII. These themes offer an avenue for further research.

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³⁷ Standard tests fail to uncover the presence of serial correlation in the residuals.

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