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## Pricing initial public offerings in premature capital markets: The case of Hungary

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The Case of Hungary**

Ibolya Schindele and Enrico C. Perotti

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# Pricing Initial Public Offerings in Premature Capital Markets: The Case of Hungary

## Summary

This paper investigates the determinants of underpricing at initial public offerings in the Hungarian Initial Public Offerings (IPO) market in 1990–1998, a period of transition from socialist to market economy and immaturity of the domestic capital market. The evidence suggests that political issues played a significant role in the process: we have found greater discount at privatization IPOs than at private issues, and a positive relation between underpricing and the proportion of shares offered for compensation coupons. These findings reinforce the hypothesis that governments in transition may pursue political objectives by selling shares at discount. Besides, the results show larger initial returns at early IPOs compared to later issues, which implies a negative relation between the discount and the maturing of the capital market. Most of the asymmetric information theories, empirically justified for well-developed stock markets, receive no support. Some results suggest that the transition related determinants of underpricing disappear as the securities market becomes more mature.

**Keywords:** Initial public offerings, underpricing, privatization

**JEL:** L33, G14

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# **PRICING INITIAL PUBLIC OFFERINGS IN PREMATURE CAPITAL MARKETS: THE CASE OF HUNGARY\***

IBOLYA SCHINDELE<sup>1</sup> – ENRICO C. PEROTTI<sup>2</sup>

A common feature of Initial Public Offerings (IPO) in capital markets all around the world is that firms systematically sell equity at significant discount compared to the true value of the company. Empirical evidence suggests that investors' initial return, the percentage price change between the offer price and the first day closing price at the stock exchange, is usually higher than 10 percent, and in many cases it reaches 45-50 percent.

This paper investigates the structure of Initial Public Offerings of shares in Hungary. As in other capital markets IPOs in Hungary appear to be underpriced, so that buying shares at the offer price at issue and selling them on the first day of trading post flotation provides investors a positive return on average. In the period 1990–1998, approximately 60 companies offered shares publicly in Hungary. These issues were underpriced by 22

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percent on average, which is not high by international standards, particularly for an emerging market (*Ibboston–Ritter*; 1994).

Table 1

<i>Average Underpricing</i>			
Country	Sample Size	Time Period	Average return (percent)
Belgium	28	1976–1989	10.2
Chile	19	1982–1990	16.3
France	187	1983–1992	4.2
Korea	347	1980–1990	78.1
Malaysia	132	1980–1991	80.3
Portugal	62	1986–1987	54.4
Spain	71	1985–1990	35.0
United Kingdom	2 133	1959–1990	12.0
United States	10 626	1960–1992	15.3

*Source: Ibboston–Ritter (1994)*

This paper seeks to establish whether this significant level of underpricing in the early period of development of the Hungarian market reflects the usual factors suggested by classical IPO theories or rather some specific features of the transition from socialist to market economy. In the period 1990–1998, economic transition is a distinguishing characteristics of the capital market in Hungary: a large proportion of IPOs is related to privatization and the market is at a premature stage of development.

The next section reviews classical theories of IPO pricing and reveals the specific characteristics of the Hungarian IPO market, which provide a background for our hypotheses. The second part of the paper describes the characteristics of issues in Hungary and details our empirical results.

## 1 THEORETICAL ISSUES

In this section we introduce theories of underpricing based on asymmetric information. These theories allow us to built several hypotheses. Further on the privatization and transition-related factors of underpricing are reviewed with a particular attention to the Hungarian case. At the end of this section the specific privatization-related hypotheses are given.

### *Theories Based on Asymmetric Information*

Several theoretical models conclude that underpricing results from asymmetric information among groups of agents taking different roles in the IPO process. Underpricing is then an incentive used to stimulate the uninformed group to act in the interest of the informed one.

Asymmetric information may exist between a firm and its investment banker. *Baron* (1982) considers a principal-agent model for a new issue underpricing based on this type of information asymmetry. The investment bank being an agent of the firm has superior in-

formation concerning its value. His compensation is a function of the proceeds from issue and the post-flotation price. The price discount, therefore, serves to induce the investment banker to put enough effort in advising and selling the firm's shares. Evidence found by *Muscarella and Vetsuypens* (1989) on investment banks going public, however, refuted this model. Underpricing proved to be significant at IPOs by investment banks as well, even though no asymmetric information existed since issuers acted as their own agents in the going public process.

Another approach to underpricing has focused on differential information of investors participating in the IPO market. *Rock's model* (1985) is based on information asymmetry between two groups of investors: informed and uninformed. The informed group knows well the prospects of firms and therefore is able to avoid buying low value IPO shares. Uninformed people have no information on firms' value, which results in a bias in their purchases towards less profitable equity issues. Anticipating this rationing bias, the uninformed group has no incentive to participate in buying shares. Underpricing is necessary to make this group enter the IPO market.

Rock's explanation was extended by *Beatty and Ritter* (1986) who studied the degree of underpricing as a function of ex-ante uncertainty concerning firm value. An increasing in uncertainty should be associated with a raise in information asymmetry, and thus with higher underpricing. As a proxy for this uncertainty, Beatty and Ritter use the post flotation variability of the share price. A positive relationship is found between this proxy and the discount involved in the offer price. As small firms have more volatile prices, this model may imply a negative relationship between firm's size and the level of discount. This hypothesis is supported by empirical studies on equity issues in the United States where large firms' offerings seem to be less underpriced. Thus measures of informational asymmetry such as size and post flotation price volatility should be regarded as explanatory factors for underpricing.

Signaling theories of underpricing focus on another type of asymmetry: differential information between firms and investors. These models assume that it is the selling entrepreneur who has superior information about the value of the IPO firm. To overcome adverse selection, companies with favorable prospects are interested to signal their value and thereby convince potential investors to buy shares. Signaling models for IPOs differ in the mechanism through which signaling occurs.

The first mechanism is signaling by equity retention. *Leland and Pyle* (1977) claim that firm value is positively related to equity retained at initial share issues. Managers of profitable companies intend to convey information about their quality to outsiders: retaining equity might be a signal of high quality. Since managers of firms with less attractive prospects have incentives to mimic good quality by issuing the signal, misleading signals have to be costly. Retaining equity can serve as a credible signal, since it is costly for firms that produce lower than average results. The higher the level of equity retained by the owners of a low value firm, the lower is the value of their residual investment and the higher the undiversified risk of their portfolio. Signaling good quality by ownership retention is then only in the interest of high value firms. This result is strongly supported by several empirical tests (*Downes-Heinkel*; 1982, *Ritter*; 1984, *Keasey-McGuinness*; 1992).

*Underpricing* is another type of signaling mechanism. Signaling by equity retention implicitly assumes that the firm has only one opportunity to sell equity in the short term. In practice, most entrepreneurs sell off their equity holdings in several stages.

Models suggesting that firms underprice initially to let investors realize larger proceeds from secondary issues were proposed by *Welch* (1989), *Allen and Faulhaber* (1989) and *Grinblatt and Hwang* (1989). Pricing initial offerings at a discount is a credible signal of firm quality: only good firms are expected to recoup the loss due to initial underpricing.

A firm that retains a large proportion of its equity may not need to discount substantially the offer price. Observing equity retention, investors rationally think the firm makes a good investment since managers have information on the firm's true quality. Alternatively, when the issuer wants to sell a large proportion of its ownership, underpricing is necessary to convince investors that the firm is of high value. Equity retention and underpricing might thus be substitute signals, which *ceteris paribus*, implies a negative relationship between them.

Besides underpricing and quantity retained, firms have *other signals* available. In the context of an IPO, original shareholders can signal firm's quality by the name and reputation of advising agents they hire. Advising agents of high reputation may reinforce the public's confidence in high firm value and bring about a reduction in asymmetric information and thus required underpricing. Several papers in the literature discuss the relation between pricing and quality of the advising agents. *Titman and Trueman* (1986) consider the choice of an auditor as an important signal, while *Booth and Smith* (1986) emphasize the quality of the underwriter. The correlation between these variables and firm's value is well supported by empirical findings (*Keasey-Short*; 1997).

Indebtedness may be a further factor referring to the future prospects of firms, since a high level of debt discourages equity investment (*Myers*; 1977, *Jensen-Meckling*; 1976). Thus indebted firms may face hurdles to signal high value at an IPO. As a consequence, it could be expected that a more indebted firm should underprice its share issue to a greater extent.

#### *Hypotheses built on IPO theory*

The previously reviewed theories imply a number of hypotheses that serve as a basis for our empirical investigation:

1. Underpricing negatively depends on firm's size. Large firms price their issues more accurately. We consider firm size (ASSET)<sup>3</sup> as the balance sheet value of total assets of the firm preceding the issue.
2. The level of underpricing is a positive function of risk (RISK), which is to be measured by the ex-post variability of share price returns.
3. Underpricing and equity retained by the issuer (RETAINED) are negatively related, since they are substitutable methods of signaling high firm value.

<sup>3</sup> Further reference to each explanatory factor is under the name indicated in brackets. See the Appendix for a more detailed description of the explanatory variables.

4. Underpricing is lower when the advising agents of the issuing firm have good reputation. Thus we hypothesize a negative relationship between the quality of underwriter (DBROKER) and underpricing.

5. The more indebted the firm, the more its shares are underpriced at an IPO. High level of indebtedness (DEBT), potentially a bad quality signal, must be outweighed by other means, like underpricing. A positive relationship is hypothesized therefore.

#### *Privatization IPOs*

In our sample, many IPOs represent privatization sales. This raises the question whether other factors than those cited in the classical literature contribute to explain the underpricing phenomenon in Hungary.

A theoretical model of IPO pricing at privatization is proposed by *Perotti* (1995). This explanation suggests that underpricing and equity retention serve the goal of signaling commitment of the selling government to a privatization policy without future redistribution of asset value. The provision of informative signals for the public is necessary because at the time of privatization, significant uncertainty exists about the government's real intentions towards the firm to be sold. For political and social reasons, governments in transition might engage in value redistribution, which may take place via taxation, indirect interference, through regulation or entry-deregulation.

A committed government is more willing to bear the costs of a delay in the final sale by retaining a part of the shares, as well as the costs of underpricing the issue. Gradual sales imply that the government is willing to bear the risk of a falling price after the sale, suggesting that it does not expect any change in its policy. When fast privatization is a prime objective, however, the government needs to sell quickly a large proportion of the shares, underpricing is needed as a costly signal of commitment. Thus ownership retention and underpricing are substitutable signals for the government to convey its political commitment. If the privatization program is not reversed, stock prices should rise over time and the government may earn substantial amounts when selling shares at subsequent issues at a smaller discount (*Laeven-Perotti*; 2001).

In the absence of large political uncertainty, privatization sales may not be underpriced to a higher degree than private issues. For several countries, however, there is much in evidence that privatization offers are more underpriced than their private issue counterparts (*Jenkinson-Mayer*; 1988, *Perotti-Guney*; 1993). *Dewenter* and *Malatesta* (1996) compare returns on initial privatization offers and on private IPOs in several countries with different levels of capital market development. Although their evidence indicates that in the United Kingdom privatization IPOs are underpriced more than private issues, they have opposite findings for other countries. While they can not identify a general tendency for privatization sales to be more underpriced than private IPOs, they do find that issues subject to larger potential political risk are characterized by a greater discount.

Besides the goal of credible privatization, underpricing may result from other political objectives of the government. The most important of these considerations are buying political support, targeting dispersed ownership, giving ownership to employees, and promoting capital market development. A hypothesis advanced in the literature is that underpricing may serve these goals (*Schmidt*; 1997, *Biais-Perotti*; 2001).



### *Privatization IPOs in Hungary*

Apart from explanations discussed in the corporate finance and privatization literature, specific characteristics of the privatization process in Hungary could also have an impact on the pricing of issues.

The privatization experience in Hungary can be characterized as following a variety of approaches. The methods applied in a particular stage of transition depended on the preferences of the ruling government. The transformation of ownership rights started in 1988. Selling companies through initial public offers became common only in the later stages of privatization. In 1990 and 1991, most of the initial offers were share sales or capital increases by private firms. Only 3 out of 13 issues were privatization IPOs, while in the years 1992–1994, 14 issues out of 18 were sales by the State Property Agency (SPA), the organization responsible for privatization of the state property. From 1995, ownership transformation through IPOs became more widespread, partly as a consequence of the implementation of the Law on Privatization (1995). Table 2 shows the distribution of IPOs in our sample, which is a good reference for the number of issues in different stages of the privatization process.<sup>4</sup>

Table 2

*Distribution of IPOs in the sample, 1990–1998*

Year	Privatization	Private issue	Total
1990	1	3	4
1991	2	7	9
1992	2	0	2
1993	5	2	7
1994	7	2	9
1995	5	1	6
1996	2	3	5
1997	4	4	8
1998	1	2	3
Total	29	24	53

An important feature of the privatization process in Hungary is its fundamental relation to restitution. Compensation of families, which suffered expropriation under the socialist regime, was a primary goal of the governments during the transition era. The main form of compensation was free distribution of the so-called ‘compensation coupons’ which could be exchanged for ownership in firms under privatization at initial share issues. These coupons were introduced to the Budapest Stock Exchange and were traded at prices usually significantly below face value. In spite of the fact that they were interest paying securities, in some periods their market value did not exceed 40 percent of the face value.

At most of the initial issues, compensation coupons were counted in the share price at full nominal value plus accrued interests. Buying coupons at the market price (or receiving them for free) and exchanging them for shares at IPOs, brought substantial additional re-

<sup>4</sup> The Table 2 is based on a group of 53 initial offers, which is somewhat less than the total number of IPOs in the period 1990–1998, but representative for the distribution of issues. Section 2 gives explanation on the difference.

turns to investors above the proceeds from classical underpricing. Thus, selling shares for coupons resulted in a special form of targeted underpricing at privatization IPOs. The proportion of stocks offered in exchange for compensation coupons provides therefore reference whether compensation policy and its related political objective had some role in underpricing the issues.

Aiming at maximizing privatization revenues, the SPA organized its sales in several rounds.<sup>5</sup> To improve the market's sentiment, at initial offers a large underpricing was applied, while substantial revenues were generated by decreasing the discount at later share issues. When aftermarket share performance is an important consideration, equity retention and underpricing may be thus positively correlated at the initial sale. When uncertainty concerning the government's future policy is high, a large initial underpricing is needed to improve investors' confidence. At the same time, most of the shares should be retained for later offers at which the discount may be set smaller. If over time political risk is resolved, gradual sales generate higher proceeds (*Laeven-Perotti*; 2001). This confronts the implication of *Perotti* (1995) that after controlling over political risk, underpricing and equity retention are substitutable signals of commitment.

A core characteristic of privatization in Hungary was the choice of selling companies to (usually foreign) strategic investors through private placements. The presence of strategic investors may refer to the possibility of more efficient restructuring and may therefore create more confidence from the public and a higher demand for shares. If the presence of strategic investors increases the public's confidence in the firm, their equity share and underpricing might be substitutable signals of high value, which generates a negative dependence between the two. The proportion of shares held by strategic investors after the issue might thus be an interesting explanatory variable.

Another goal of the privatization process was the allocation of shares to employees. Selling underpriced shares to employees helps to create support from insiders, which is an essential condition for the success of privatization. Without employees' acceptance, a change in ownership might be impossible to realize. In Hungary, at several IPOs a significant fraction of shares was separated and offered exclusively to the firm's employees. Such a practice creates strong labor support for privatization and stimulates employees to contribute to an efficient company operation following the ownership change, which are necessary conditions for the success of transition. The proportion of shares offered to employees should therefore be included as a possible explanatory factor in the investigation on IPO pricing.

Another distinguishing feature of the privatization process in Hungary may be the role it played in the creation of the country's stock market. Governments during transition regarded the goal of capital market development as of primary importance, since a liquid stock market may provide funds for corporate investments and attract foreign capital. The substantial number of privatization IPOs (see Table 2) and their large proceeds (see Table 3)<sup>6</sup> compared to the revenues from private issues indicate that privatization indeed contributed to the creation of the stock market in Hungary.

<sup>5</sup> Maximizing proceeds from privatization was an important objective of the governments in transition, since Hungary needed to pay back all of its debt accumulated during the socialist era, for which the financial means came primarily from privatization.

<sup>6</sup> The Table 3 is based on our sample. See description of the sample in section 2.

Table 3

*Proceeds from IPO sales, 1990–1998*

Year	Privatization	Private	Total
	(1000 USD)		
1990	36 750	27 786	64 536
1991	8 613	35 346	43 959
1992	44 237	0	44 237
1993	37 837	15 775	53 613
1994	181 408	1 336	182 744
1995	244 399	6 316	250 714
1996	251 324	106 508	357 832
1997	1 136 788	64 869	1 201 657
1998	6 691	106 172	112 863
<i>Total</i>	<i>1 948 047</i>	<i>364 108</i>	<i>2 312 155</i>

We claim that on markets in a premature state, one needs to underprice more than on markets in a more progressed stage of development. This hypothesis is supported by evidence that underpricing is much larger in developing countries than in efficient capital markets (see Table 1). This phenomenon may imply that IPOs occurred in the early 90-ies in Hungary, soon after the reopening of the stock exchange and thus in a primitive capital market, were priced at a greater discount than later issues.

*‘Privatization-related’ hypotheses*

Privatization and the process of transition certainly influenced the development of the IPO market in Hungary. Thus we need to consider further hypotheses that relate underpricing to the former discussed ‘transition and privatization related factors’.

6. Privatization IPOs are more underpriced than private issues. In our sample, we distinguish privatization offers from private issues by a dummy variable (DPRIV).<sup>7</sup>

7. The proportion of shares sold in exchange for compensation coupons (COMPENS) is positively related to underpricing.

8. Underpricing and equity retained at the initial issue are correlated. When revenue maximization is the main objective, a positive relationship may exist. These variables are however negatively related when the principal consideration of the government is signaling its commitment to a sustained privatization policy.<sup>8</sup>

9. The greater the proportion of strategic investors in the ownership structure, the lower the discount. Our measure is the post-IPO ownership share of strategic investors in the firm (STRATEGIC).

10. The greater the proportion of shares that the firm’s employees own following an IPO (EMPLOYEE), the higher the discount at the issue.

<sup>7</sup> This hypothesis does not unambiguously originate from the transition state of the economy. Greater underpricing at privatization IPOs is also a characteristic of several developed stock markets.

<sup>8</sup> Hypothesis 8 is a modification of the original statement about the relation between underpricing and retained equity (hypothesis 3).

11. The more developed the capital market, the less underpriced the issue. The later the IPO occurred in the sequence of issues at the Budapest Stock Exchange (BSE), the lower is the discount at sale. We identify each issue by a counting variable (DSEQUENCE), which is to be increased by one at each subsequent IPO.

## 2. EMPIRICAL RESULTS

In this section, first the methods of the investigation are briefly summarized. This is followed by the description of the data used and the remaining part is devoted to a detailed analysis of the estimations.

### *Methodology*

To estimate the relationship between underpricing and the explanatory variables, we apply simple OLS (Ordinary Least Squares) methodology. We justify our choice by several test statistics on residual series, which we include in the tables (see Table 5 and 6) showing our results.

The definition of the dependent variable, underpricing, is an important methodological issue in IPO studies. Underpricing is usually defined as the percentage change between the offer price and the first day closing price of the trade. This measure is called raw underpricing.

$$UP_i = \frac{P_{i,1} - P_{i,0}}{P_{i,0}},$$

where  $P_{i,0}$  is the offer price at issue  $i$ , and  $P_{i,1}$  is the closing price of share  $i$  on the first day of trading on the Stock Exchange.

However, actual stock market tendencies may influence prices to a large extent. Therefore, an adjustment is necessary to make in order to see the real value of the discount. As it is customary in the literature, we estimate regressions for adjusted underpricing, which is the difference between raw underpricing and the percentage change in the market index between the date of subscription and the first day of trading.

$$AUP_i = UP_i - \frac{INDEX_{i,1} - INDEX_{i,0}}{INDEX_{i,0}},$$

where  $INDEX_{i,0}$  is the closing value of the market index on the last day of subscription of IPO  $i$  and  $INDEX_{i,1}$  is the closing value of the market index on the first day of quotation of the shares issued at IPO  $i$ .

### *Description of Data*<sup>9</sup>

Our dataset is built on the entire population of IPOs occurred in Hungary before January 1999. 53 share issues are considered, which is somewhat less than the total number of IPOs in this period. Altogether 67 companies offered shares publicly in Hungary after the reopening of the Budapest Stock Exchange in 1990, until the end of 1998. We disregard 14 issues for the following reasons:

- 6 out of the 14 were offerings of shares of investment funds or specialized asset management companies. Considering that portfolio management companies bear different characteristics than companies in the usual production and services industries, their valuation may require a different approach. Therefore, characteristics of the underpricing phenomenon in relation to these companies might also substantially differ.
- Another 8 issues (most of these firms were soon de-listed) are disregarded, because data were not available either on the issue or the firm itself. For most of these firms, the number of stock exchange transactions was insignificant for a period of at least six months following the issue (in a few cases even underpricing could not be calculated).

In conclusion, the dataset includes almost all IPOs in Hungary. Therefore, although the sample size is somewhat small, significant variables identified in regressions must have explanatory power as the sample represents almost the entire population.

Among the 53 initial issues, 29 are privatization IPOs and 24 are private share issues (capital increase or private sale). Adjusted underpricing is 22 percent on average in the entire population. Privatization IPOs are underpriced by 31 percent on average; while for private issues the average discount is only 10.7 percent. Thus the hypothesis that private issues tend to be priced more accurately seems to hold in the IPO market of Hungary.

Table 4

*Descriptive Statistics on Underpricing*

Denomination	Privatization IPOs		Private IPOs		Whole Sample	
	underpriced	adjusted underpricing	underpriced	adjusted underpricing	underpriced	adjusted underpricing
Sample size	29	29	24	24	53	53
Mean (percent)	30.4	31	6.8	10.7	19.7	21.8
Standard deviation (percent)	34.3	38	25.3	35.3	32.5	37.9
Minimum (percent)	-20.4	-20.4	-52.2	-58.4	-52.2	-58.4
Maximum (percent)	102.4	110	63.5	110.4	102.4	110.4

Taking adjusted underpricing into account, the maximum level of the discount in the population is 110.4 percent. At the same time, 15 initial issues were overpriced (negative underpricing). The lowest value is -58.4 percent. Among the overpriced issues 7 were privatization IPOs and 8 were private sales.

<sup>9</sup> The authors collected data from issued prospectus of IPO firms, yearly financial statements of companies, and time series of share prices and the BUX index, all of which were provided by the Information Center of the Budapest Stock Exchange. The Company Fact Book, which contains information on companies floated in Hungary, was also a useful source of information.

Among the 53 Initial Public Offers, 11 implied pure capital increases, while in case of the other 42 issues an (at least partial) sale of already existing shares occurred.

### Estimation

Tables 5 and 6 in this section present our empirical results. They show regression estimations for adjusted underpricing as a dependent variable. Each column represents a different regression. Values for the estimated parameters are in rows; *t*-statistics are in brackets. Stars indicate significant explanatory variables.

Table 5

Variables	Estimation results			
	Model			
	REGR1	REGR2	REGR3	REGR4
Constant	0.09 (0.56)	0.10 (0.70)	0.14 (0.87)	0.22 (1.34)
log(ASSET)				
DPRIV				
COMPENS	0.66*** (4.25)	0.87*** (5.88)	0.60*** (3.56)	0.82*** (4.50)
DEBT	0.26 (1.27)	0.40** (2.21)		
DSEQUENCE	-0.003 (-1.12)	-0.01*** (-3.30)	-0.002 (-0.62)	-0.01*** (-2.72)
DBROKER			0.07 (0.53)	0.17 (1.34)
STRATEGIC	0.02 (0.09)	0.16 (0.89)		
RISK	-0.03 (-0.12)	-0.08 (-0.30)		
RETAINED			-0.04 (-0.24)	-0.05 (-0.31)
EMPLOYEE				
Statistics				
Sample size	53	44	42	34
<i>F</i> -statistics	3.74***	6.77***	3.41***	6.45***
Adjusted <i>R</i> <sup>2</sup>	0.21	0.40	0.20	0.40
White Heteroscedasticity	1.31	0.62	1.71	0.93
Durbin–Watson statistics	1.81	1.76	2.06	2.37
Residuals' Skewness	0.40	0.26	0.53	0.86
Residuals' Kurtosis	3.26	3.21	2.85	3.18
Chow Forecast Test at 44	2.86***		2.64**	

\* 10 percent significance level.

\*\* 5 percent significance level.

\*\*\* 1 percent significance level.

Note. *t*-statistics in brackets.

The sample size may differ in the regressions presented. Table 5 shows four regressions that constitute two pairs. Both regressions in a pair are based on the same explanatory variables but they are built on different samples. REGR 1 considers the entire sample (53 observations), while REGR 2 concerns share issues exclusively in the period 1990-1996, and thus builds on a smaller sample (of 44 observations). The same holds for the other pair, REGR 3 and 4 in Table 5, and also for the two pairs of regressions in Table 6.

Table 6

Variables	<i>Estimation results</i>			
	Model			
	REGR5	REGR6	REGR7	REGR8
Constant	0.18 (1.92)	0.28*** (2.97)	0.15 (1.40)	0.28** (2.46)
log(ASSET)	0.02 (0.65)	0.02 (0.67)		
DPRIV			0.21** (2.04)	0.21** (1.92)
COMPENS	0.58*** (3.99)	0.70*** (4.49)		
DEBT DSEQUENCE	-0.004 (-1.06)	-0.01*** (-2.81)	-0.002 (-0.62)	-0.01*** (-2.28)
DBROKER STRATEGIC RISK RETAINED				
EMPLOYEE	-0.10 (-0.24)	-0.04 (-0.08)		
Statistics				
Sample size	53	44	53	44
F-statistics	4.38***	6.63***	2.16	3.78**
Adjusted $R^2$	0.20	0.34	0.04	0.11
White Heteroscedasticity	0.69	0.38	1.19	1.37
Durbin–Watson statistics	1.83	1.86	1.48	1.43
Residuals' Skewness	0.35	0.26	0.54	0.78
Residuals' Kurtosis	3.11	3.10	2.98	3.84
Chow Forecast Test at 44	2.24**		1.59	

\* 10 percent significance level.

\*\* 5 percent significance level.

\*\*\* 1 percent significance level.

Note. *t*-statistics in brackets.

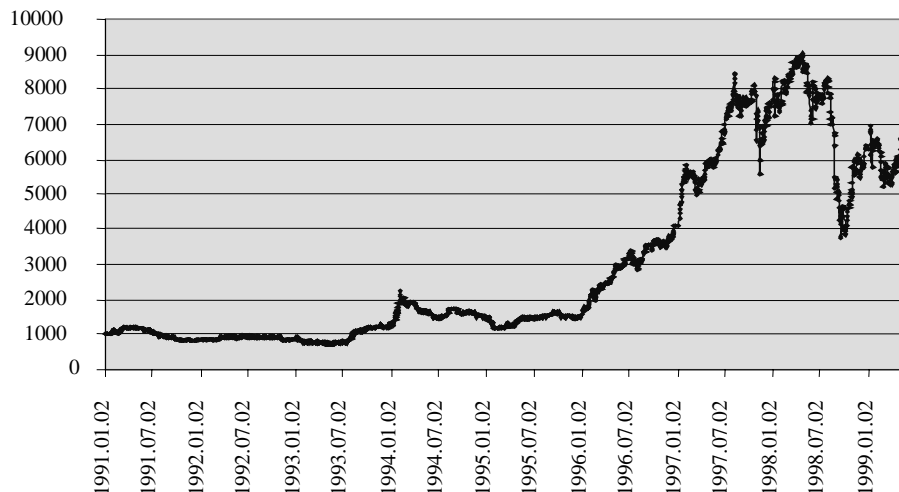
The reason for using different samples to estimate underpricing is the following. We claim that in Hungary, the primary characteristics of capital market development differ before and after January 1997, which may influence IPO pricing to a great extent. The early period of transition, 1990-1996, saw a balanced expansion of the stock market, characterized with a progressive upward movement of the market index (BUX) and low volatility. On the contrary, in the more mature phase of market development after 1997, the index ex-

hibited extremely high volatility and market crashes (see Figure 1). On the one hand this is a consequence of international economic and financial market developments: the Russian and Asian financial crises seriously affected trading at the Budapest Stock Exchange during 1997–1998. On the other hand, the relatively large number of shares quoted (see Table 1) in this period, high liquidity compared to earlier stages, and the high values of the index indicate a more mature phase of development of the capital market for 1997–1998. We find justification by stability tests that features of IPO pricing indeed differ in the two periods and that the determinants of underpricing can be more easily explained for the earlier, rather smooth phase of market evolution.

The sample size may differ for another reason. When retained equity (RETAINED) is chosen as an explanatory variable, only a small number of observations (42 in the entire period) can be used for estimation purposes (REGR 3 and 4).<sup>10</sup> The reason for this is that equity retention applies only to sales of existing shares. For the group of capital increase IPOs, the relation between equity retention and underpricing cannot be tested.

Concerning the structure of our estimations, we are limited by correlation among the explanatory variables. Offers for compensation coupons occurred only at privatization IPOs, thus we need to estimate the relation of COMPENS and DPRIV to underpricing in separate regressions. Firm size is also correlated with the privatization dummy, since privatization IPO firms are typically of greater size than privately owned issuing companies.

*Figure 1. Index values at the Budapest Stock Exchange, 1991–1998*



In most of the regressions, explanatory variables have a strong joint effect on adjusted underpricing (significant  $F$ -statistics). The best explaining variables are COMPENS and DPRIV, which are significant independent of the sample size. Both have the positive hypothesized sign. This supports our hypotheses that compensation for expropriation under

<sup>10</sup> In regression 3, the sample size is 42 instead of 53. 11 observations are excluded from the estimation because equity retention is irrelevant (capital increase IPOs).



socialism substantially affected IPO pricing and that privatization IPOs were underpriced to a greater extent than private issues in the Hungarian stock market.

By far the most significant and highest value coefficient estimate concerns the proportion of shares offered for compensation coupons (COMPENS). This indicates that underpricing occurred particularly in case of those privatization IPOs that allowed for buying shares in exchange for coupons. At sales for coupons underpricing remains hidden in a sense, since its targeted value is implied in the low coupon price instead of a low announced issue price. This is especially true if we take into account (as discussed earlier) that at certain issues coupons could be purchased at the BSE at a price substantially below face value and that they were counted at their nominal value increased with interests at the exchange for shares.<sup>11</sup> This may reinforce our hypothesis on governments in transition pursuing political objectives by the means of underpricing. Especially targeted underpricing may encourage more people to obtain share ownership at IPOs, since it allows for a purchase of shares at an extremely low cash price. Support by a new middle class of citizens might bring substantial political benefits for the privatizing government. Higher discount at privatization IPOs may thus be further evidence on the government's incentives to gain popularity.

The large initial underpricing at privatization deals may be related to the government's consideration for the IPO shares' post-flotation performance. In case of many companies, the SPA applied the strategy of gradual sales on the stock market accompanied with substantial underpricing at the initial public offer. The objective was to achieve a smaller discount and generate large revenues at subsequent share issues. This strategy to privatization is theoretically justified in *Laeven and Perotti* (2001): when the company is sold gradually, later sales are priced more accurately reflecting the resolution of political risk.

Governments in transition may have an incentive to sell shares at discount to signal their commitment to a privatization policy without future interference (*Perotti*; 1995). Only a committed government can bear the costs of the initial underpricing of privatization shares. Equity retention can be another means of signaling credibility, thus equity retained by the government at issues should be negatively correlated with the discount (*Perotti-Guney*; 1993). In our estimations the coefficient of retained equity has a negative sign, but underpricing is not significantly affected by this variable.

Greater discount at privatization issues may also refer to the desire of achieving dispersed ownership structures. Governments in transition may aim at creating widely dispersed ownership of public firms in order to bring liquidity to the capital market and thus to give strength to its development. We claim that the substantial underpricing at privatization IPOs in Hungary was to a large extent to stimulate the expansion of the stock market. This is supported by the finding that underpricing was smaller at later issues than at early IPOs, especially in the more premature phase of stock market development (before 1997), as the negative coefficient of DSEQUENCE shows.

Estimations based on the entire population of IPOs in 1990–1998 (REGR 1, 3, 5) suggest that the relationship between underpricing and the independent variables is unstable. This is shown by significant Chow Forecast test statistics: in May 1997 (at observation 44), there may be a structural change in the estimated models. Re-estimation of each equation

<sup>11</sup> Our data on underpricing involve this 'hidden underpricing' as well. See a detailed explanation on calculation of underpricing in the Appendix.

for the sub-sample of issues in 1990–1996, (REGR 2, 4, 6, 8) gives better results (higher coefficient values and  $R^2$ , higher  $F$ -statistics). This change in the explanatory characteristics of underpricing may provide evidence that the features of stock market development differ before and after March 1997. Underpricing can be better explained for the period 1990–1996, when a smooth, progressive expansion and small volatility describes the stock market. When the entire period of 1990–1998 is considered, our models can justify only a smaller part of the variation in the discount.

We underline that the balanced evolution of the stock market in the period 1990–1996 occurred at a low level of market development. From 1997 onwards the volume of trading achieved much higher levels than ever before and volatility also increased to a large extent. Uncertainty implied by a more mature but still inefficient stock market may prevent the establishment of well fitting regression models that could explain the pricing phenomenon. At such a ‘low maturity’ phase, transition and privatization related explanations might become inappropriate. At the same time, classical asymmetric theory models may not apply yet.

Apart from higher explanatory power and better fit for the period 1990–1996, we find justification for the relation between underpricing and the variable representing the level of stock market development (DSEQUENCE). This implies that early IPOs were priced at a greater discount than late ones, but this holds only for the period 1990–1996. This finding justifies the idea that transition related underpricing disappears as the stock market enters a more progressed phase.

We emphasize that almost all significant explanatory variables (COMPENS, DPRIV, DSEQUENCE) relate to privatization, transition, and the immaturity of the capital market. The finding that privatization IPOs are underpriced to a greater extent than private sales holds for some more matured markets as well. Our estimations reject most of the classical asymmetric information theories on IPO pricing. The coefficient of firm size has a positive sign, which is opposite to our expectations. This may be due to the fact that in our sample offers by large firms relate to privatization of state holdings, which may result in higher underpricing. However, the coefficient is not significantly different from zero. Neither the relation between underpricing and risk, nor the dependence of the discount on the quality of underwriter can be justified. Equity retention has no statistical significance either.

The only asymmetric information theory that is reinforced by our estimations concerns the leverage of issuing firms. Classical corporate finance theory claims that a high level of debt may prevent refinancing projects and therefore implies a negative signal on the firm’s future prospects. Indebted IPO firms should therefore use underpricing as a counter-signal to convince investors of their high value. For the period 1990–1996, we indeed find a significant positive relationship between underpricing and debt level at firms issuing shares in Hungary.

Since in the early transition period, bank debt was hardly available and therefore rarely used by Hungarian firms, companies capable to obtain debt financing were better than average. Thus we claim that for the Hungarian sample debt financing and underpricing should be complementary rather than substitutable signals of high value: only good firms, able to raise debt, could recoup the costs of underpricing. This may explain the positive relationship in our estimation (regression 2).

### 3. CONCLUSIONS

The most important finding of this paper is that initial public offerings are underpriced in Hungary just as in other countries. The level of this underpricing was approximately 22 percent in the period 1990–1998. This is higher than the average discount in countries with well functioning stock markets but substantially lower than initial returns on several premature capital markets (*Ibboston–Ritter*; 1994).

The underpricing phenomenon in the period considered strongly relates to the transition state of the economy and the low maturity of the capital market. Particularly, privatization of state owned companies, restitution, and thus the privatizing governments' political objectives play a central role in the determination of the discount. Asymmetric information theories, many empirically justified for well-developed markets, do not receive support for IPOs in Hungary.

The most important explanatory factor for the discount concerns compensation. The higher the proportion of shares offered in exchange for compensation coupons, the greater the underpricing at IPO. The low coupon price that characterizes most of the period allows for a relatively high offer price and a low cash price of shares, at the same time. Thus the discount is involved in the coupon price instead of the offer price itself. We call this phenomenon hidden underpricing.

We argue that hidden underpricing in a period of transition may be a policy by the government to pursue objectives such as gaining political support, signaling commitment, and stimulating the capital market. This result reinforces some privatization theories for transition economies, such as *Perotti and Guney* (1993), *Perotti* (1995), *Schmidt* (1996), and *Biais and Perotti* (2001), and provides further justification for the empirical findings by *Jones et al.* (1999).

Another main result of this paper is that privatization IPOs are underpriced to a significantly greater extent than private sales. The average discount at issues by the State Property Agency (the government institution responsible for privatization) was 31 percent (adjusted for market variation), while private issues were underpriced on average only at 11 percent. This finding is in accordance with empirical results by *Paudyal et al.* (1998) concerning IPOs in an emerging economy, Malaysia.

An interesting finding of our paper is that underpricing can be much better explained by factors advanced by the privatization literature when one considers offers exclusively in the period 1990–1996. Estimations for the entire population of issues in 1990–1998 show less significance and smaller explanatory power. We claim that the reason is that transition related explanations better describe the underpricing phenomenon in the early transition stage, a period of smooth and balanced expansion of the capital market, than in a more mature but still inefficient state of the stock market in the years 1997–1998. At the same time in the immature stage, asymmetric information theories are not yet appropriate. The evidence that IPO underpricing decreases with market development and the fact that this holds only for the early transition period, reinforces our idea that transition-related underpricing slowly disappears as the securities market becomes more mature.

These results suggest that in a transition period, when privatization IPOs take place within a primitive capital market, explanatory variables, which relate to the particular circumstances of the privatization process and the country itself are needed. The main conclu-

sion of this research is the strong significance of these privatization- and country-related explanations.

## APPENDIX

### DEFINITION OF EXPLANATORY VARIABLES

*Underpricing (UP)*: percentage return of investors if they buy at the offer price and sell at the first day closing price at the initial issue.

*Remarks*: 1. When a significant proportion of shares was offered for compensation coupons (CC) and investors could buy coupons at the market price, the offer price is a weighed average of the compensation coupon price and the cash price. The weight is the proportion offered in exchange for compensation coupons.

2. At several IPOs, only certified compensation coupons were accepted in exchange for shares. Certified CCs could be used only by their original owners and were not traded on the Budapest Stock Exchange. However, an unofficial secondary market existed for these certified coupons so that private investors could buy them from their owners at roughly 40 percent premium above the prevailing price at the BSE, and use them to purchase shares at IPOs. Our raw underpricing measure does not reflect this premium in the coupon price and may thus, to a small extent, overestimate the discount at privatization IPOs. Since prices at this secondary market are hypothetical, we use the coupon price as quoted on the BSE in our calculations of the underpricing variable.

3. If the introduction of the shares to the Budapest Stock Exchange occurred more than a month following the issue, we considered the first day closing price deflated to its value at the time of subscription (for certain times yearly inflation was above 30 percent during the period under investigation).

*Adjusted underpricing (AUP)*: difference between raw underpricing and the percentage change in the market index between the date of subscription and the first day of trading (see a more detailed explanation in section 2).

*Assets (ASSET)*: total assets of the IPO firm according to the balance sheet closing the year preceding the issue.

*Risk (RISK)*: variability of excess returns on the share (post-floatation), expressed by the variance of the differences between daily returns on buying and selling the particular share and daily returns on buying and selling the market portfolio.

*Remark*: As the expected return on a share depends on the performance of the entire market, and such market risk is unavoidable in a premature market, the risk of an investment is better described by the difference between the behavior of a share and the whole market. We thus calculate the variability of excess returns on shares compared to the market portfolio, represented by the BUX index, a weighed average of price changes of the most often traded securities in the Budapest Stock Exchange.

*Retained equity (RETAINED)*: ratio of the number of shares retained to the total number of shares owned by the issuer.

*Reputation of the firm's underwriter (DBROKER)*: a dummy variable taking the value 1 if the issue is underwritten by a foreign investment bank or brokerage house, or by a syndicate of at least three financial services companies, otherwise its value is 0.

*Indebtedness (DEBT)*: ratio of total debt to total assets as stated in the balance sheet of the year preceding the IPO.

*Type of the issue (DPRIV)*: quality variable taking a value of 1 if the issue is a privatization IPO, and 0 otherwise.

*Proportion of shares offered for coupons (COMPENS)*: the number of shares offered in exchange for compensation coupons as a percentage of the total number of shares offered for sale at the IPO.

*Employee ownership (EMPLOYEE)*: proportion of shares owned by employees following the IPO.

*Ownership of strategic investors (STRATEGIC)*: the percentage share of the firm's equity strategic investors own following the issue.

*Level of stock market development (DSEQUENCE)*: a counting variable, which has a value 1 for the first IPO in the sequence of issues, and the value of which is increased by 1 at each subsequent issue.

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Network		
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- (xlii) This paper was presented at the International Workshop on "Climate Change and Mediterranean Coastal Systems: Regional Scenarios and Vulnerability Assessment" organised by the Fondazione Eni Enrico Mattei in co-operation with the Istituto Veneto di Scienze, Lettere ed Arti, Venice, December 9-10, 1999.
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- (liii) This paper was circulated at the International Conference on "Climate Policy – Do We Need a New Approach?", jointly organised by Fondazione Eni Enrico Mattei, Stanford University and Venice International University, Isola di San Servolo, Venice, September 6-8, 2001
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- (lvii) This paper was presented at the First Workshop of "CFEWE – Carbon Flows between Eastern and Western Europe", organised by the Fondazione Eni Enrico Mattei and Zentrum für Europäische Integrationsforschung (ZEI), Milan, July 5-6, 2001
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