Determinants of underpricing of initial public offerings (IPOs) of BRICS companies

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Abstract

The purpose of this article is to identify the nature of the influence of crucial factors on the short-term underpricing of initial public offerings of common stocks of companies in the BRICS countries. Based on a sample of 1,141 companies from the BRICS countries that conducted IPOs (using Bloomberg and World Bank databases), we tested the influence of decisive factors on the underpricing of the shares of these companies. The empirical study is based on testing OLS models for different periods: for the period 2001−2018 and separately for the periods 2001−2008 and 2010−2018. The study shows that, firstly, with an increase in the volume of the placement of shares, their underestimation in an IPO decreases. In addition, having an auditor from the Big Four also reduces the underestimation of shares. Secondly, we revealed that the underpricing of shares in the course of an IPO increased with GDP growth. Besides, if companies place their shares on a foreign exchange, the underestimation of their shares increases. At the same time, such IPO parameters as the number of underwriters, the reputation of underwriters, and the deviation of the offer price from the middle of the price range during the placement period do not affect the underestimation of shares for companies from the BRICS countries. Taking into account the results of an empirical study, the article formulates recommendations for improving the efficiency of initial public offerings for companies from the BRICS countries.

Keywords: underpricing of shares during the placement, IPO, common stock, companies from the BRICS countries.

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Introduction

The economic development of the BRICS countries has made it necessary for companies to raise additional funding through an initial public offering (IPO). Of course, the primary purpose of issuing common stock is to attract a significant amount of financial resources to finance large projects. At the same time, during the placement of shares, they are often underpriced when the price of offering shares to investors is lower than the closing price on the first day of trading. In 2020, in the United States, the average underpricing of shares during an IPO was 41.6%.[1] The phenomenon of undervaluation is observed not only in countries with developed stock markets, such as the United States, but also in almost all world stock markets. Underestimation by countries ranges from 3% to 240%.[2] In 2020, underestimation of 1,755 IPOs averaged 49.7%.[3] The most important question is which theoretical model best explains this phenomenon of underestimation and which factors significantly impact the underestimation of shares of companies in the BRICS countries? Despite many publications about underestimation, the real reason for this phenomenon is still a matter of controversy. There is no dominant theory that could cause this phenomenon. The article studies the influence of key factors on the short-term underestimation of shares of companies in the BRICS countries in the framework of IPOs.

Firstly, the authors explain the phenomenon of underpricing of stocks and analyze theories that explain the reasons for the underestimation in IPOs. Then we substantiate hypotheses regarding the influence of crucial factors on the underpricing of shares of companies in the BRICS countries. Next, the paper describes companies selected for the research and the results of the empirical study. Finally, we formulate recommendations for improving the efficiency of IPOs for BRICS companies.

1. Analysis of literature and substantiation of the research

1.1. Underpricing of IPOs: Concept and measurement

An initial public offering (IPO) is an initial public sale of a company's common stock and a listing of shares on a stock exchange. A critical moment in the issue of shares is to determine the price at which the shares will be placed on a stock exchange. Despite the popularity of IPOs for raising funds, there is an anomaly associated with underpricing the issuer's shares on the first day of trading. Today underpricing is the crucial indicator of the effectiveness of an IPO. The term "underpricing" first appeared in the US academic literature in the 1970s. In modern literature, there are various concepts of this phenomenon. Underpricing of a stock is the difference between its offering price (i.e. the price at which investors buy a stock before they start trading) and the

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[1] https://www.vedomosti.ru/opinion/articles/2021/03/02/859929-ipo-maniya

[2] https://quote.rbc.ru/news/article/603931979a794790aca96263

[3] Ibid.

price of the stock at the close of trading on the first day of its listing (Clarin & Neville, 2018). According to Snippert, underestimation of an IPO is the difference between the closing price on the first day of trading and the offering price (Snippert, 2015). In their article, Ibbotson, Sindelar and Ritter define the initial return as the difference between the placement price and the closing price on the first day of trading in the secondary market (Ibbotson et al., 1988). The disadvantage of the above definitions is that we cannot compare the underpricing between different companies since we calculate the indicator in absolute terms. Below we give definitions of underpricing, which we measure as a relative indicator.

Dolvin defines *underpricing* as a percentage change in the offer price of a common stock relative to the closing price on the first trading day (Dolvin, 2012). A. Napolnov suggests that the closing price of the first trading day significantly affects the success of the IPO. The relative change in price on the first day is called "the first day of trading return" or "initial return." This return forms the primary return for investors. The effect of high initial profitability is also called the underpricing of the IPO or the "phenomenon of underpricing" (Napolnov, 2010). According to Wen, underpricing is a percentage change in the closing price of the first trading day relative to the bid price (Wen, 2005).

We will use the following definition. *Underpricing is a percentage change in the closing price of the first trading day relative to the bid price.* The offer (placement) price of a share is the price at which an investor buys the share when the underwriters draw up an order book, i.e. before trading on the stock exchange.

So, underestimation can be measured in the following ways. The *first way* to measure underestimation is shown in formula (1), where underestimation is measured in absolute terms (Saunders & Lim, 1990; Lee et al., 1996):

$$IR = P - E, \tag{1}$$

IR — initial return; P — the market closing price of the common stock on the first trading day; E — offer price of the share.

However, with this calculation, the indicators of underestimation of different companies are not comparable; therefore, it is not suitable for use in our study.

The second way:

$$UNDP = \ln \frac{FDCP}{OP}, \tag{2}$$

$UNDP$ — underpricing; $FDCP$ — the market closing price of the stock on the first trading day (first-day closing price); OP — offer price of the stock.

This formula makes it possible to compare indicators. The use of the natural logarithm is standard in finance when dealing with interest, including simplifying the interpretation of research results.

The third way:

$$UNDP = \ln \frac{P}{E} - \ln \frac{M}{M_0}, \tag{3}$$

$UNDP$ — underpricing; P — the market price of the share at the close of the first trading day on the stock exchange; E — offer price of the share; M — market index at the close of the first trading day; M_0 — market index at the time of the placement of the share; $UNDP$ — underpricing.

This formula takes into account the impact of market conditions on the dynamics of the stock on the first day of trading. Therefore, we consider Formula 2 to be the most appropriate way to measure the undervaluation of a stock. In well-developed capital markets and in the absence of restrictions on how much stock prices can fluctuate daily, the underpricing becomes evident rather quickly, necessarily by the end of the first day of trading. Therefore, when calculating the underpricing of an IPO, most authors use the closing price of the first day of trading in their studies.

1.2. Conclusions of the main theories regarding the reasons for the underpricing of shares in the framework of their initial public offering

The problem of underestimation has existed since the 1960s. Research in this area can be divided into several large theories: information asymmetry theory, institutional theory, ownership and control theory, and behavioral theory.

Information Asymmetry Theories

Rock model (Winner's curse / Rock's model). Kevin Rock in his article suggests that underpricing arises from the presence of two groups of investors on the market: investors possessing insider information about the company and its valuation, and investors who do not have high-quality and complete information about the fair price of shares (Rock, 1986). The resulting information asymmetry disturbs the equilibrium when buying shares. Informed investors buy shares of companies with stable financial performance and development vectors, while uninformed investors are forced to invest in a company based solely on their forecasts and expectations. As a result, uninformed investors risk buying up a large number of overvalued shares, which could lead to their exit from the market due to low investment returns. With a fair valuation of shares by the issuer, the demand for them will be significantly lower due to the withdrawal of some investors from the market. To eliminate the superiority of informed investors and create the image of a profitable company, the issuer deliberately underestimates its stake (Azhikhanov, 2011).

Ex-ante uncertainty. Beatty and Ritter used Rock's model (Rock, 1986) and suggested that the underpricing was related to the expected uncertainty about the value of the listed company (Beatty & Ritter, 1986). Since the future performance is subject to uncertainty, investors need to extract information about their future investments. The issuer, in turn, does not aim to disclose complete information concerning the issue, which increases the costs of investors to obtain information about the company. Thus, Beatty and Ritter suggested that underpricing compensated investors for the cost of obtaining information

due to uncertainty. It should be noted that this hypothesis has found empirical confirmation in many publications.

Entrepreneurial Wealth Losses & Certification. Habib and Ljungqvist introduce an addition to the Rock model (Rock, 1986). In the Rock model, the issuer deals with the problem of underpricing and adverse selection. The issuer reduces information asymmetry due to additional disclosure costs, thereby reducing company's losses and underpricing. However, the benefit of reducing the underpricing may not offset the cost of producing information. Therefore, issuers will reduce information asymmetry as long as the marginal cost of reducing underpricing equals the marginal benefit (Habib & Ljungqvist, 2001). The obvious way to reduce information asymmetry is to hire a prestigious underwriter, a reputable auditor. The underwriter's brand is also used as a "certificate" for the reputational capital of the bank (Booth & Smith, 1986).

Book building theory.[4] The theory was first put forward in an article by Benveniste and Spindt (1989). An order book allows underwriting banks to define the price range more accurately and place the price at the top of the range. To establish a fair share price, underwriters need to obtain information from institutional investors who have more in-depth knowledge of the company's value. However, it is not profitable for institutional investors to disclose such valuable information. Instead, they provide information on the fair value of shares if they receive a large share of the undervalued shares in return (Benveniste & Spindt, 1989). It should be noted that the effect of the book-building mechanism on the underpricing of shares in the framework of an IPO is almost impossible to directly investigate due to the confidentiality of the data.

The principal-agent model assumes an asymmetry of information between the issuer (principal) and the underwriter (agent) when the underwriter bank has much more complete information about the fair price of a company's share (Baron, 1982). The way to test this hypothesis is to study IPOs characterized by low information asymmetry or its absence. This occurs if the underwriters own a stake in the issuer or when investment banks undertake IPOs. For example, Muscarella and Vetsuypens studied 38 IPOs of investment banks in which the issuers (investment banks) acted as underwriters. Since the underwriter and the issuer are one person, there should be no agency problem (Muscarella & Vetsuypens, 1989). However, the underestimation was at about the same level as IPOs, which gives the authors a reason to interpret the results as contradicting the principal-agent model.

A large share of stock makes it possible to participate in pricing. In his article, Reuter correlated the volume of shares allocated to institutional investors with their stakes in these companies after the issue. He found a positive relationship between the commissions paid to the top underwriter and the fund's equity post-IPO. The fact is that funds buy undervalued IPOs, paying high commissions to underwriters. Mutual funds are among the institutional investors in this study. The underwriters and the fund are "in collusion;" the underwriter deliberately underestimates the IPO, distributes

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[4] Book building — drawing up an order book to study the demand for shares from potential investors and form the price of shares.

a share to the fund, and receives a commission from the fund's purchase of shares. According to the authors' assessment, underwriters receive 85% of their commissions from underestimated profits (Reuter, 2006). Based on this theory, we can conclude that the information asymmetry between the issuer and the underwriter negatively affects underpricing.

Signaling theory. The main contribution to this theory was made by Allen and Faulhaber and some other authors (Allen & Faulhaber, 1989; Grinblatt & Hwang, 1989; Welch, 1989). According to the theory, there are two types of companies in the market that cannot distinguish between investors: high quality and low quality. High-quality companies signal their high quality to raise capital on favorable terms. Low-quality companies can only imitate what makes them high quality in the market. The signal is the price of the stock. High-quality companies with good performance tend to sell at below-market prices to differentiate themselves from low-quality companies. Since low-quality companies do not have the opportunity to underestimate the valuation, this method is beneficial for high-quality issuers who expect compensation for damage from the discount during the subsequent placement. Grossly underestimated IPOs receive comprehensive media coverage, which is beneficial for both investors and the issuer. The opportunity to conduct such a successful deal will attract investors for future IPOs.

Institutional theories

Lawsuit avoidance. The issuer and the underwriter wish to avoid legal liability under US federal securities laws for inaccurate information in a prospectus. According to the Securities Act of 1933, the amount of damage increases by the difference between the offer price and the lower market price after trading on the stock exchange. According to this hypothesis, the greater the difference between the offering price and the subsequent market price, the less likely a lawsuit is, and the less likely an unfavorable court decision is in case of a lawsuit from investors. However, actual damage in the US is limited to the bid price. Lowry and Shu estimated that 5.8% of US-based companies were subject to legal liability (Lowry & Shu, 2002, 315), and the average litigation loss was 13% of the proceeds from the placement (Lowry & Shu, 2002, 317). Thus, underpricing reduces the likelihood of subsequent damage. The likelihood of litigation during an IPO in the BRICS countries is very low due to the poorly developed judicial system. Therefore, this theory is not suitable for explaining the reason for the underpricing in the BRICS countries.

Price stabilization. In an initial public offering, the underwriter has the right to use legal tools to maintain the share price at the desired level. A common practice is the price stabilization mechanism — the underwriter supports the market price of shares after the IPO. To maintain price control, the underwriter will take a short position on 10−20% of placement issues. This strategy allows to stabilize prices by increasing or decreasing supply. Depending on price fluctuations, the bank makes decisions using the green shoe option. The theoretical concept of price stabilization was initially developed by Booth and Smith (1986), formalized by Benveniste, Busaba and Wilhelm (Benveniste et al., 1996) and proved its statistical validity in the US market in empirical articles by Ruud (Ruud,

1993) and Ellis, Michaely and O'Hara (Ellis et al., 2000). Successful price intervention truncates the lower range of the stock price distribution, thereby mechanically creating a positive average underestimation.

Tax benefit. Underestimation can be beneficial from a tax point of view. A hypothesis is put forward in the work by Taranto. The US tax system provides incentives for managers to undervalue shares in an IPO. Managers and employees who hold stock options pay tax in two stages. First, when exercising any option, they pay income tax on the income from the difference between the strike price of the share option and the market price. Second, on the subsequent sale of the underlying shares that it acquired due to the exercise of the option, capital gains between the fair market price and the selling price are taxed (Taranto, 2003). US tax law considers the fair market value of options exercised in connection with an IPO to be the offer price, and not the price that will prevail in the market after the start of trading (Yuan, 2009). Thus, it creates an incentive for underestimation. The tax system of the BRICS countries does not provide an incentive for underestimating IPOs, so this theory cannot be used to explain the reason for underestimation in these countries.

Ownership and control theories

Managerial control. Brennan and Franks suggest that undervaluation is a way to preserve the personal gain of management through strategic share allocations when going public (Brennan & Franks, 1997). Managers are reluctant to hand over large blocks of shares to institutional investors who can test the quality of management and its drive to maximize company value. A small fraction of an institutional investor's shares reduces external control. First, due to the strong dispersion of stocks among investors, monitoring becomes a public good, and investors will invest in a low level of monitoring (Shleifer & Vishny, 1986). Secondly, many investors with small stakes reduce the likelihood of a hostile takeover and displacement of the current management. The role of underpricing in this hypothesis is to create excessive demand for stocks, making it possible to reduce each investor's share. In the BRICS countries, most large companies are controlled by the state or by a single private owner; therefore, the possibility of transferring a large stake to an institutional investor and the likelihood of a takeover are excluded. Also, the management does not have strong incentives to underprice since they will in any case be controlled by the main shareholder in the person of the state or an investor with a large stake.

Agency costs. The behavior of managers seeking to maintain control of the company may change after the IPO due to agency costs. Agency costs between managers and shareholders arise from insufficient funds raised in the IPO process and a further decline in stock prices. Managers who own shares of the company bear these costs to the same extent as other owners. If agency costs may ultimately exceed the benefits of protecting private interests, then it becomes more profitable for managers to reduce their control over the company. Stoughton and Zechner argue that the transfer of a significant shareholding to a large investor increases the company's value due to the fact that the investor receives external control over management (Stoughton & Zechner, 1998). If the ownership of the

company is scattered, then monitoring will be weak. It is not profitable for small investors to invest in monitoring since all shareholders will benefit from it. To improve monitoring, managers can allocate a large block of shares to one of the investors. However, from an investor's point of view, it can be risky to invest in a large shareholding. As an additional incentive, undervalued shares are offered to investors.

Behavioral theories

The theory of informational cascades. According to Welch, uninformed investors copy the behavior of knowledgeable investors (Welch, 1992). The increase in the bid price is interpreted as positive information previously received by investors about the quality of the shares. Even when they receive a signal about a possible revaluation, uninformed investors ignore it and apply to buy shares. In this case, successful initial sales encourage investors who buy shares later to invest in shares, regardless of whether they have their own information. With low initial sales, investors who buy shares after the placement may opt-out of the purchase. Thus, the demand for stocks is either growing or remains low. Such information cascades are due to the lack of free communication among investors. The absence of a free information flow is an advantage for the issuer, since the probability of widespread dissemination of negative information is reduced. In addition, information cascades give the earliest investors bargaining power, which may demand more undervaluation in exchange for early bids, stimulating demand.

Sentimental investors. In addition to irrational investors, sentimental investors also influence the stock price. Since most of the companies listed on the stock exchange are relatively young and non-transparent, it is pretty difficult to assess them and their impact on investors, and the market is also unpredictable. Ljungqvist, Nanda and Singh suggest that some investors are optimistic about the company's future (Ljungqvist et al., 2004). Therefore, the issuer tries to maximize the excess of the valuation over the share's internal (fair) value. Overflowing the market with stocks cause the price to decline, so the issuer holds the stock to adjust the price. As a result, the market will bring the share price to fair value. However, regulatory restrictions prevent the issuer from using this strategy directly. The best option in this case is to distribute shares among institutional investors, who will then resell them to optimistic investors at prices prevailing in the market due to supply constraints. Such speculation can be risky for institutional investors due to unpredictable demand from optimistic investors, as demand may end prematurely. Therefore, they demand a discount in the form of undervaluation. Moreover, even undervalued shares benefit the issuer in this configuration.

The main conclusions of the considered theoretical concepts are presented in Table 1. It can be concluded that the most appropriate theories explaining the reasons for underestimation for the BRICS countries are the theories of information asymmetry and some conclusions of the institutional theory. Ownership and control theories, as well as behavioral theories, target more developed markets, such as the US and the UK.

Table 1. Theoretical models explaining the phenomenon of underpricing

Theories	Scientific article	Conclusions of the theory
Information asymmetry theories		
Rock model	Rock, 1986	Underestimation arises due to the presence of two groups of investors on the market: informed and uninformed
Ex-ante uncertainty	Beatty & Ritter, 1986	Investors need to underestimate stocks to offset the expected uncertainty
Entrepreneurial wealth losses & certification	Habib & Ljungqvist, 2001 Booth & Smith, 1986	The issuer reduces information asymmetry due to additional costs of information production, thereby reducing the company's losses and underpricing
Book building theory	Benveniste & Spindt, 1989	In the book-building process, institutional investors provide information to the underwriter about the demand, expecting an underestimated share of the company's shares in the future
The principal-agent model	Baron, 1982	Information asymmetry exists between the issuer (principal) and the underwriter (agent)
Signaling theory	Allen & Faulhaber, 1989 Grinblatt & Hwang, 1989 Welch, 1989	High-quality companies with good performance seek to sell below market shares to differentiate themselves from the low-quality group of companies
Institutional theories		
Lawsuit avoidance	Lowry & Shu, 2002	Underestimation arises from the desire of the issuer to avoid legal proceedings with investors after the placement
Price stabilization	Ruud, 1993 Ellis, Michaely & O'Hara, 2000	Successful price intervention truncates the bottom of the stock price distribution, thereby mechanically creating a positive average undervaluation
Tax benefit	Rydqvist, 1997	Underestimation is used as a way to optimize taxes
Ownership and control theories		
Managerial control	Brennan & Franks, 1997	Underestimation is a way to preserve the personal benefits of management through strategic share allocation
Agency costs	Stoughton & Zechner, 1998	Underpricing is an incentive for a prominent investor, whom the issuer wants to attract to improve monitoring
Behavioral theories		
The theory of Informational cascades	Welch, 1992	Underpricing occurs when ignorant investors copy the behavior of knowledgeable investors
Sentimental investors	Ljungqvist et al., 2004	Underpricing is a risk compensation for institutional investors speculating in the interests of the issuer

1.3. Substantiation of hypotheses about the influence of factors on the underpricing of IPOs of companies in the BRICS countries

Having considered theoretical concepts and empirical models, let us formulate hypotheses regarding the influence of factors on the underestimation of IPOs.

Hypothesis 1: Uncertainty about the future value of the company has a positive effect on underestimation. This hypothesis is put forward in the work of Beatty and Ritter and is consistent with the theory of expected uncertainty. The authors suggest that the greater the expected uncertainty, the greater the underestimation (Beatty & Ritter, 1986). This hypothesis was empirically confirmed in the course of research. Various proxies are used for verification. In our study, placement volume is used as a determinant (Beatty & Ritter, 1986). Larger volumes are offered by stable companies, while smaller volumes are issued by at-risk companies, which increases the uncertainty about their future value. Therefore, the level of underpricing of stable companies is lower than that of small ones. It is also easier for investors to get information about large companies faster than about small ones, which reduces their costs, and, therefore, they require less underestimation.

Hypothesis 2: Placing stocks above the middle of the price range has a positive effect on underestimation. This hypothesis is consistent with the book building theory. Institutional investors disclose information while filling the order book, which allows underwriters to determine the range of the offering more accurately. Investors provide such a service to the underwriting bank in order to underestimate a larger block of shares. Therefore, an IPO with positive information from investors should be placed at the top of the price range. Using this information, the underwriter partially adjusts the share price as a reward to the investors who provided the information. Thus, the placement occurs at the top of the price range. We use the deviation of the bid price from the middle of the price range to measure this determinant (Ibbotson et al., 1988).

Hypothesis 3: The prestige of underwriters and auditors negatively impacts underestimation. This hypothesis is consistent with the theory of entrepreneurial losses and certification. A hypothesis is suggested by Booth and Smith, and Habib and Ljungqvist (Booth & Smith, 1986; Habib & Ljungqvist, 2001). The authors argue that the issuer uses the underwriter's brand as evidence of a fair valuation of the company. The updated Carter and Manaster rating (Carter & Manaster, 1990) can be used as a rating. Auditors also play an essential role in the IPO process. Enron's history of manipulation of financial statements and the collapse of one of the largest audit firms in the world, Arthur Anderson, has diminished confidence in the financial market. Therefore, the reliability of reporting is an essential criterion for investors. Lees and Wahal argue that a prestigious auditor is an additional signal of stock quality (Lees & Wahal, 2004).

Hypothesis 4: Information asymmetry between the issuer and the underwriter has a positive effect on underestimation. This hypothesis is consistent with the principal-agent theory. The underwriter is a key player in the IPO process. The principal-agent problem arises between the issuer and the underwriter. Top underwriters have more professional information about the value of companies and the state of the market. Only the underwriter bank can fairly evaluate the company. In this connection, the underwriter has additional

incentives to conceal this information. For example, if a bank participates in a deal and buys back shares for further sale on the secondary market, it would be natural to underestimate the company and increase its margin. To test the hypothesis, one can use the number of underwriters (Korsten, 2018) participating in the company's IPO process. Several underwriter banks accompany most modern IPOs, and, therefore, the more of them, the stronger the information asymmetry between the issuer and the underwriters.

Hypothesis 5: The placement of shares on a foreign market negatively affects undervaluation. This hypothesis is consistent with the signaling theory. Issuers try to make their issue the most attractive for investors. Therefore, the placement of shares on a prestigious foreign stock exchange will be a positive signal for investors. In addition, compliance with strict requirements of listing on a popular exchange indicates the high quality of its shares and increases interest in them.

Hypothesis 6: GDP growth rate has a positive effect on underestimation. The BRICS share in global GDP gradually increased between 2001 and 2018. The prospects for such growth certainly stimulated the investment opportunities of the countries. As a result, IPO activity increased dramatically from 2000 to 2010. In 2010, the share of BRICS in the total IPO volume was 60%. Most of the growth in emerging capital markets is related to economic growth. Therefore, it is advisable to include in the model an indicator of the state of the economy of each of the countries in certain periods. Hence, the GDP growth rate is used as a determinant of economic growth.

2. Research model

Most modern studies identify the reasons for IPO underpricing on the example of developed markets, such as the United States and the United Kingdom. The markets of specific countries and individual stock exchanges are also studied. Generally, multiple linear regressions (MLR) are used, based on the influence of various factors on the dependent variable — the IPO underpricing. Researchers also use Logit and Probit models of the probability of IPO underpricing.

In the study (Xu & Zhao, 2014), the authors determine the factors of IPO underpricing of Chinese companies using an MLR model. The dependent variable is the IPO underpricing, and the influencing factors are various parameters of companies, exchanges, and IPO. The authors also use a Probit model with the same influencing factors on the probability of IPO underpricing. The sample includes 2,031 IPOs of Chinese companies on the Shanghai and Shenzhen stock exchanges from 1990 to 2010. The model evaluates the influence of the parameters of companies, exchanges, and IPOs on the underpricing of the Chinese IPOs and identifies differences in the levels of underpricing of state and private companies. The authors determine that the factors of Chinese IPOs underpricing are *information asymmetry, the state's share in the company, and risk.*

Azhikhanov (2011) focuses on the London Stock Exchange IPOs from 1996 to 2008 and identifies the factors influencing the IPO underpricing on this stock exchange. The author uses an MLR model. The total sample of 906 companies is divided into

several groups depending on factors. Further, the author divides the companies into two subgroups: 774 local and 132 foreign. The advantage of this model is the identification of differences in significant factors of IPO underpricing of local and foreign companies. The *volume* of foreign companies' IPOs increases the underpricing more than that of local ones. At the same time, the *underwriter's reputation* reduces the IPO underpricing in foreign companies more than in local ones.

Korsten (2018) identifies the IPO underpricing factors on European stock exchanges from 2010 to 2017. The variables of interest for research are high-tech companies, IPO volume, underwriters' rating and their number. The model also considers the fixed effects of the country and the year of the IPO. *The author states that the reputation and the number of underwriters influence the level of IPO underpricing.*

Nazarova (2017) conducts a factor analysis of the IPO underpricing of Russian companies from 1996 to 2015. The author uses a Logit model and evaluates factors using the maximum likelihood estimation (MLE).

It is worth noting that the advantage of the multiple linear regression, in contrast to the Logit and Probit model, is the ability to quantify the influence of a factor, and not just the probability of IPO underpricing.

The dependent variable in our study is the IPO underpricing (UNDP). It is calculated as the natural logarithm of the ratio of the first-day closing price to the offer price. We have developed a multiple linear regression to study the influence of factors on the IPO underpricing of the BRICS countries.

$$UNDP = \alpha + \beta_1 \, ln(Size) + \beta_2 \, RangeDev + \beta_3 \, Number + \beta_4 \, Reputation +$$
$$+ \, \beta_5 \, Big4 + \beta_6 \, Foreign + \beta_7 \, GDPgrowth + Years + Cntry + \varepsilon.$$

## 3. Description of the selection of companies for the research

IPO data and macroeconomic data were sourced from *Bloomberg and the World Bank* databases. For the study, we compiled a sample of IPOs of BRICS companies. First, we formed IPOs from 2001 to 2018 (5,257 IPOs). Second, we excluded 511 IPOs of financial sector companies whose characteristics and pricing are different from other sectors. Finally, we excluded from the sample IPOs for which there were no data. The final sample included 1,141 IPOs (Table 2).

Table 2. Sample selection criteria

IPOs of BRICS companies from 2001 to 2018	5,257
Financial sector IPOs	(511)
Missing data	(3,605)
Final sample	**1,141**

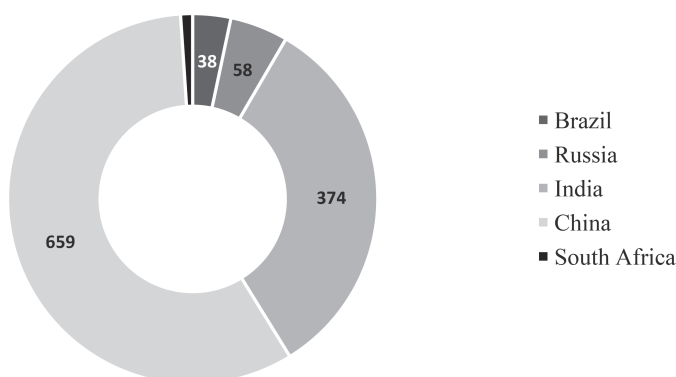*Source:* compiled by the authors based on the Bloomberg database.

The distribution of the final sample by year and the average underpricing for a given year is shown in Figure 1. We note a high level of average IPO underpricing in 2001–2002. A possible explanation for this could be the recovery from the dot-com bubble and the low number of IPOs in these years. From 2004 to 2009, there was both an increase in the total number of IPOs and an average underpricing. From 2010 to 2018, the underpricing is stable and ranges from 5% to 25%. In addition, there is no longer such a pronounced positive relationship between the indicators as in 2004–2009.
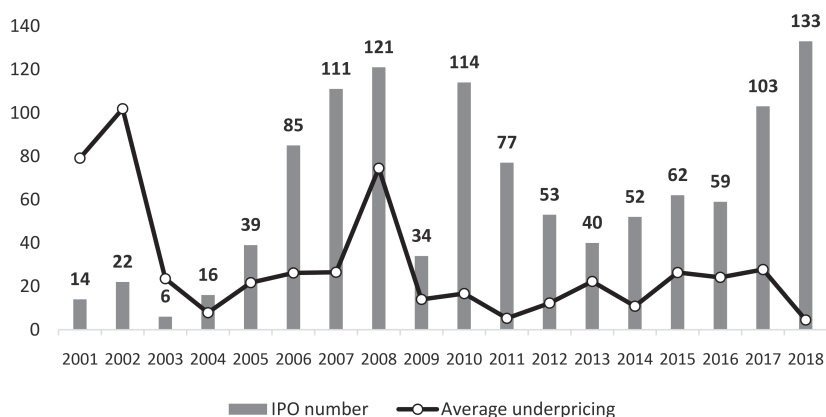
Source: compiled by the authors based on the Bloomberg database.

Figure 1. Total number of IPOs and average underpricing

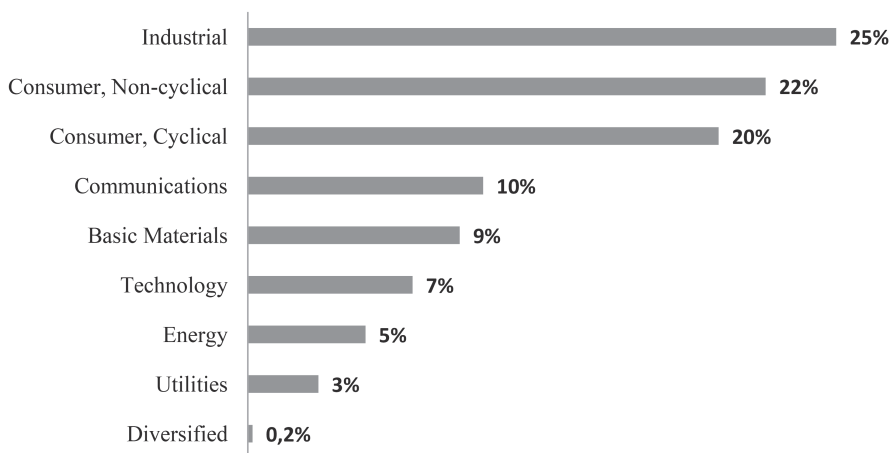Figure 2 shows the distribution of IPOs by country. Most of the listed companies are Chinese, and a third of the IPOs in the sample are Indian. Russia, Brazil, and South Africa account for less than 10% of IPOs.

Source: compiled by the authors based on the Bloomberg database.

Figure 2. Number of IPOs by country

Most companies belong to sectors such as industry, consumer goods and telecommunications (Figure 3).

Industrial — 25%
Consumer, Non-cyclical — 22%
Consumer, Cyclical — 20%
Communications — 10%
Basic Materials — 9%
Technology — 7%
Energy — 5%
Utilities — 3%
Diversified — 0,2%

Source: compiled by the authors based on the Bloomberg database.

Figure 3. Distribution of IPOs by sector

Descriptive statistics of the main variables used in the study are presented in Table 3. It should be noted that there is a significant difference between the average IPO underpricing and its median value. The average IPO underpricing is 26.32%, while the median IPO underpricing is 6.92%. On average, companies raise about $267 million in IPOs. The deviation of the offer price from the middle of the price range is on average −0.34%. The number of underwriters ranges from 1 to 23, with an average of 2.24 underwriters per IPO. 34% of companies hire reputable underwriters for IPOs. Nearly half of companies employ prestigious accounting firms of the "Big Four." 13% of companies practice listing on foreign stock exchanges. The average GDP growth rate for 2001−2018 in the BRICS countries is 7.84%.

Table 3. Descriptive statistics

Variable	Average	Median	Standart Deviation	Min	Max
UNDP (%)	26.32	6.92	65.31	−84.38	926.60
Size ($m)	266.90	75.15	952.1	0.60	25032.00
RangeDev (%)	−0.34	0.75	11.57	−48.41	150.00
Number	2.24	2.00	1.99	1.00	23.00
Reputation	0.34	0.00	0.47	0.00	1.00
BIG4	0.49	0.00	0.50	0.00	1.00
Exchange	0.13	0.00	0.34	0.00	1.00
GDP growth (%)	7.84	7.77	2.23	−1.97	14.23

Source: compiled by the authors based on the Bloomberg database.

Analysis of the scatter plot of the IPO volume and underpricing shows some patterns (Figure 4). As the volume of IPO increases, the underpricing decreases on the first trading

day. The level of IPO underpricing with small volume (up to $500 million) is significantly higher compared to larger IPOs. At the same time, the probability of IPO overpricing increases, i.e. negative dynamics on the first trading day.
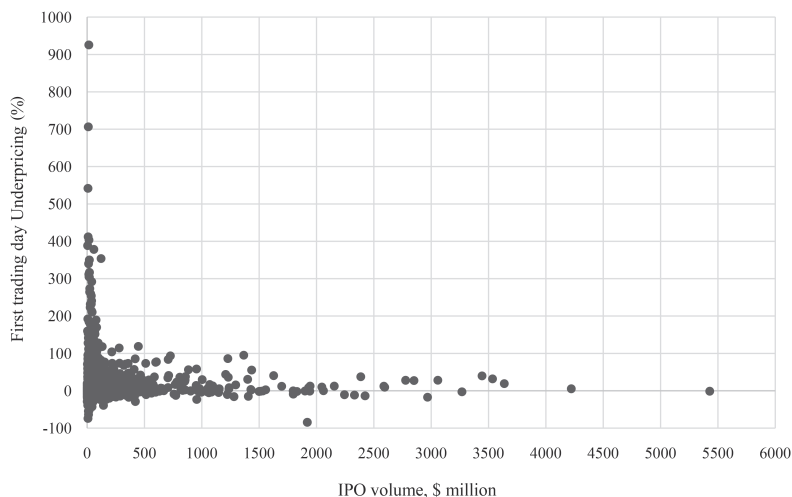
Source: compiled by the authors based on the Bloomberg database.

Figure 4. The scatter plot of IPO volume and underpricing

Initial analysis of the correlation matrix (Figure 5) shows some interrelationships between the variables. The UNDP_Perc is expressed as a percentage.
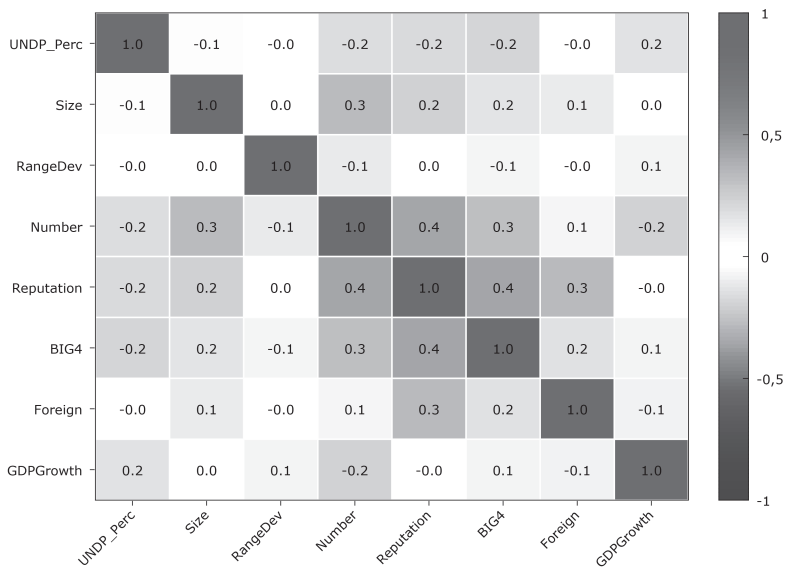
Source: calculated by the authors based on the Gretl program.

Figure 5. Matrix of paired correlation coefficients

4. Research findings

4.1. Results and their interpretation

First, we built a model using the OLS method for the entire sample of companies for the period from 2001 to 2018. The results are shown in Table 4. *Model 1* included only quantitative variables without dummies and the GDP growth rate. Only the variable number of underwriters was significant at the 1% level. Next, we added binary variables and the GDP growth rate to the model *(Model 2)*. The variable number of underwriters lost its significance. The variables underwriter's reputation, prestigious auditor and the GDP growth rate are significant at the 1% level, and the variable foreign stock exchange is significant at the 10% level. In *Model 3*, we added fixed annual effects. It is worth noting an increase in the adjusted R^2 of more than 10%. *Model 4*, in addition to annual effects, also considers fixed country effects. The variable IPO volume has become significant, even though it was not significant in previous models. The variable reputation of the underwriter has lost its significance. The variables prestigious auditor, foreign stock exchange and GDP growth rate retained their significance in Model 4. The variables deviation of the offer price from the middle of the price range and the number of underwriters are not significant.

Table 4. OLS regressions for 2001−2018

	Model 1	Model 2	Model 3	Model 4
const	0.250***	−0.025	−0.140***	0.150***
	(0.029)	(0.041)	(0.039)	(0.056)
lnSize	−0.006	0.001	−0.010	−0.023***
	(0.006)	(0.008)	(0.009)	(0.009)
RangeDev	−0.000	−0.001	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
Number	−0.028***	−0.006	0.004	0.007
	(0.005)	(0.004)	(0.004)	(0.004)
Reputation		−0.083***	−0.063***	−0.039
		(0.022)	(0.024)	(0.024)
BIG4		−0.117***	−0.084***	−0.159***
		(0.021)	(0.020)	(0.027)
Foreign		0.065*	0.093***	0.064**
		(0.033)	(0.033)	(0.032)
GDP growth		0.035***	0.038***	0.022***
		(0.004)	(0.005)	(0.008)
Years		No	Yes	Yes
Country		No	No	Yes
n	1.141	1.141	1.141	1.141
Adj. R²	0.029	0.103	0.214	0.242

Note: the value of the standard error is indicated in parentheses below the coefficient values, ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Source: compiled by the authors.

Table 5. OLS regressions in 2001–2008 and 2010–2018

	Model 1		Model 2		Model 3		Model 4	
	2001–2008	2010–2018	2001–2008	2010–2018	2001–2008	2010–2018	2001–2008	2010–2018
const	0.549***	0.137***	0.069	0.014	0.150*	−0.073	0.450***	0.108
	(0.064)	(0.031)	(0.079)	(0.050)	(0.088)	(0.051)	(0.116)	(0.067)
lnSize	−0.038***	−0.003	−0.009	−0.001	−0.036*	0.002	−0.043*	−0.010
	(0.014)	(0.006)	(0.020)	(0.006)	(0.021)	(0.008)	(0.022)	(0.008)
RangeDev	−0.005**	0.003**	−0.005***	0.003*	−0.003*	0.003*	−0.002	0.003**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Number	−0.066***	−0.009**	−0.008	−0.001	0.020	−0.002	0.025	−0.001
	(0.023)	(0.004)	(0.019)	(0.004)	(0.021)	(0.005)	(0.023)	(0.004)
Reputation			−0.145***	−0.063***	−0.070	−0.057***	−0.067	−0.032
			(0.049)	(0.021)	(0.052)	(0.021)	(0.052)	(0.023)
BIG4			−0.185***	−0.032	−0.151***	−0.046**	−0.219***	−0.110***
			(0.045)	(0.023)	(0.045)	(0.022)	(0.050)	(0.035)
Foreign			−0.038	0.123***	−0.007	0.125***	0.061	0.084**
			(0.087)	(0.033)	(0.082)	(0.032)	(0.086)	(0.033)
GDPGrowth			0.046***	0.015***	0.054***	0.020***	0.037*	0.014
			(0.006)	(0.005)	(0.007)	(0.006)	(0.022)	(0.018)
Years					Yes	Yes	Yes	Yes
Country					No	No	Yes	Yes
n	414	693	414	693	414	693	414	693
Adj. R²	0.076	0.024	0.201	0.049	0.275	0.080	0.293	0.103

Note: The value of the standard error is indicated in parentheses below the coefficient values, ***p < 0.01; **p < 0.05; *p < 0.1.

Source: compiled by the authors.

Second, we divided the sample into two periods: 2001–2008 and 2010–2018. It should be noted that we excluded 2009 due to the outbreak of the global financial crisis at that time and a sharp decline in the number of IPOs, which may distort the estimate. The division into periods reveals potential differences in the factors of IPO underpricing before and after the global financial crisis. The results are presented in Table 5. All variables are significant in *Model 1* for both intervals, except for the variable IPO volume for 2010–2018. However, in *Model 2*, the variable IPO volume lost significance in both periods, as did the variable number of underwriters. In addition, in Model 2, the variables underwriter reputation and GDP growth rate are significant at the 1% level in both periods. In *Model 3*, which considers fixed annual effects, the variable deviation of the offer price from the middle of the price range remains significant, as in the previous models. The variable reputation of the underwriter loses its significance in the period 2001–2008 but remains significant for the second period. The variable prestigious auditor is significant in both periods. The final *Model 4* includes fixed annual and country effects. The variable deviation of the offer price from the middle of the price range loses its significance in 2001–2008. However, it is significant at the 5% level in 2010–2018. The variable prestigious auditor is significant at the 1% level in both periods. The variable IPO volume and the rate of GDP growth are significant at the 10% level in the period 2001–2008, as well as the variable foreign stock exchange is significant for the period 2010–2018.

Table 6 presents the model results for each of the countries. It is rather hard to focus on the model coefficients for Brazil and Russia since the sample of companies from these countries is small. The variables deviation of the offer price from the middle of the price range and the reputation of the underwriter are significant for Indian companies. The variables IPO volume, prestigious auditor and GDP growth rate are significant for companies from China.

Table 6. OLS regressions for each of the BRIC countries

	Brazil	Russia	India	China
const	43.677***	0.865	−0.539*	−6.676***
	(12.150)	(0.570)	(0.296)	(2.057)
lnSize	0.011	−0.099	0.006	−0.049***
	(0.032)	(0.101)	(0.012)	(0.011)
RangeDev	0.002	0.004	0.007**	0.001
	(0.002)	(0.005)	(0.003)	(0.001)
Number	−0.015	0.027	0.015	0.002
	(0.010)	(0.041)	(0.016)	(0.005)
Reputation	−0.048	0.231	−0.115***	0.038
	(0.029)	(0.270)	(0.038)	(0.028)
BIG4	0.027	0.081	0.043	−0.250***
	(0.075)	(0.099)	(0.040)	(0.038)

Table 6. Continued

	Brazil	Russia	India	China
Foreign	−0.018	−0.024	0.165	0.021
	(0.036)	(0.123)	(0.138)	(0.042)
GDPGrowth	−32.891***	−0.228	0.025	1.015***
	(9.194)	(0.218)	(0.040)	(0.307)
Years	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes
n	38	58	374	659
Adj. R²	0.469	0.277	0.114	0.360

Note: The value of the standard error is indicated in parentheses below the coefficient values, ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Source: compiled by the authors.

Hypothesis 1 (positive impact of uncertainty about the future value of the company on IPO underpricing) was confirmed for the BRICS countries (variable — IPO volume). The impact of uncertainty on IPO underpricing in the BRICS countries can be explained in the following way. In Russia, Brazil and South Africa, only large stable companies that are monopolists or one of the leaders in their industry reach the IPO. So, investors do not demand high underestimation for such companies since they seem to be the least risky. There are also many companies listed on the stock exchange in China, including small ones that are at risk. Consequently, investors demand higher underpricing compared to large companies. *Hypothesis 3 (the negative impact of a prestigious auditor on IPO underpricing)* was partially confirmed. A reputable auditor is an intermediary between the investor and the issuer. Due to his reputation capital, he reduces the asymmetry of information between them. This gives a positive signal to the market, which reduces the risks for investors. This also confirms *Hypothesis 6 (the positive impact of the GDP growth rate on IPO underpricing)*. During periods of economic growth, investor demand for IPOs increases and is accompanied by excessive optimism. Therefore, the share price may rise much higher than its fair value on the first trading day.

Hypothesis 5 (the negative impact of placing shares on a foreign stock exchange on IPO underpricing) is not confirmed. IPOs on a foreign stock exchange for BRICS companies increases their underpricing. A possible explanation for this is that most of the BRICS companies have a state-owned stake. This could be a negative signal for developed market investors. They consider political disagreements between Russia and China on the world stage and the internal political instability in Brazil. Variables for testing *Hypothesis 2 (the positive impact of placing shares at a price above the middle of the price range)* and *Hypothesis 4 (the positive impact of information asymmetry)* are not significant.

Hypothesis 3 is confirmed both for the periods before (2001–2008) and after (2010–2018) the global financial crisis. However, after the crisis, the influence of a prestigious auditor on IPO underpricing decreased by almost 13%, more than twofold. This is probably due to the decline in confidence in the financial markets after the crisis of 2009. *Hypotheses*

1 and 3 are confirmed only for the period 2001–2008. Rapid economic growth and an increase in the number of IPOs in the BRICS countries occurred precisely in the period before the crisis. There was a marked recession in Brazil, Russia, and South Africa that lasted for several years after the crisis. Only Chinese companies were able to return to the pre-crisis IPO volumes and even increase the number of IPOs compared to the pre-crisis period. It should be noted that in the period 2001–2018, all other things being equal, the GDP growth rate increased IPO underpricing by 2.2%, and in the period 2001–2008, this coefficient increased to 3.7%, which is consistent with our explanation of this phenomenon.

The position of the offer price in the price range becomes significant after the 2009 global financial crisis and confirms *Hypothesis 2 (the positive impact of the placement at a price above the middle of the price range)*. It confirms the existence of information asymmetry between underwriters and investors. An IPO on a foreign stock exchange also affects the underpricing after the crisis. Placing shares on a foreign stock exchange for the post-crisis period increases the underestimation by 2% more than in 2001–2018. In our opinion, some events that can be considered a negative signal for the financial market could have affected this. In particular, political disagreements between Russia and other countries that began after 2013–2014 and the tense relations between China and the United States, which culminated in the trade war. A corruption scandal also erupted in Brazil, which ended with the impeachment of the incumbent president.

We should interpret the models for companies from *India and China*, as their test results and samples allow us to draw some important conclusions. All other things being equal, a 1% increase in the deviation of the offer price from the middle of the price range increases the underestimation of shares by 0.7% for Indian companies. The average number of underwriters participating in an IPO is 1.9, which is the lowest among the BRICS countries. Based on these indicators, we can draw the following conclusion. The problem of information asymmetry between investors and underwriters in the Indian IPO market is higher compared to the rest of the BRICS countries. Also, a reputable underwriter reduces the underpricing of Indian IPOs by 11.5%, all other things being equal. We assume that the importance of the underwriter's reputation capital for the Indian IPO market is related to the asymmetry of information between underwriters and investors. Companies use a reputable underwriter as one way of reducing information asymmetry.

As for the IPOs of Chinese companies, the IPO volume affects the underpricing. China is the world leader in the number of IPOs. Companies with different IPO volumes go public. Investors will demand more underpricing for small companies than large ones. *Also, all other things being equal, a prestigious auditor reduces the underpricing of Chinese IPOs by 28.4%*. It is the largest coefficient for this variable of all the models shown. The Big Four companies did not monopolize the Chinese audit market that much. Local Chinese auditors give audited companies more freedom in preparing financial statements than Western companies. A large proportion of modified audit opinions are typical for Chinese companies. On average, 11% of listed Chinese companies received a modified audit opinion in 1992–2011 (Lin et al., 2011). This phenomenon points to a strong incentive to distort information in China. Consequently, the market is more sensitive to company reports prepared by prestigious auditors. The GDP growth rate also affects the IPO

underpricing for the Chinese companies. China is the only country in the BRICS group that has demonstrated stable economic growth from 2001 to 2018.

To sum up, the significant factors of IPO underpricing for the BRICS companies are the IPO volume, the prestige of the auditor, the GDP growth rate, and the placement of shares on a foreign stock exchange.

4.2. Recommendations for improving the efficiency of IPOs for BRICS companies

The favorable situation in the global markets and the eager activity of the BRICS countries' companies make it possible to draw up recommendations for improving the efficiency of issuing companies from the BRICS countries, based on the results of our empirical research.

Chinese companies should conduct an additional audit of the company with the help of the Big Four companies, as distortion of information in financial statements is typical for the Chinese market. All other things being equal, a prestigious auditor will reduce the IPO underpricing by 28%.

The information asymmetry between the key participants in the IPO is relevant to the *Indian IPO market.* A way to reduce the information asymmetry is to inform investors about the company value using various signals. Indian companies use a reputable underwriter to reduce information asymmetry. In addition to a reputable underwriter, Indian companies should employ prestigious auditors. It will be easier for a company to attract a reputable underwriter to an IPO by working with a prestigious auditor. The combined effect of the auditor and the underwriter on reducing IPO underpricing will be higher.

In Russia, the period from the decision to hold an IPO to going public is beginning to shorten. This gives young companies much more opportunities to stay in the market. According to our research, uncertainty about the future value of the company does not have such a strong impact on IPO underpricing in the BRICS countries. Therefore, small and medium-sized companies should consider going public early. One of the ways to reduce uncertainty can be cooperation or a joint project with a large company. Most large companies in the BRICS countries are monopolists or leaders in their industry, which reduces risks.

Over the past year, the *Brazilian IPO market* has seen an excessive number of placements against the background of the government's cut in the base interest rate and an influx of more local retail investors into the exchange. Brazilian issuers should refrain from placing during periods of severe overheating in the market and wait for a more optimal window for an IPO, as confidence in economic stability in the country increases after the recession and political crises.

Companies from *South Africa* prefer going public on foreign stock exchanges, which, other things being equal, increases the IPO underpricing for BRICS companies. A foreign exchange gives companies access to a much larger number of investors. However, it is worth considering the possibility of a dual listing. Such practice can reduce IPO underpricing and boost the development of domestic markets.

Conclusion

In this article, we identify the impact of various factors on the IPO underpricing of companies in the BRICS countries.

For empirical analysis, we used traditional models previously used in research on this topic. We chose the ordinary least squares (OLS) method for the study. We used the following metrics as factors influencing the IPO underpricing: IPO volume, deviation of the offer price from the middle of the price range, number of underwriters, reputation of the underwriter, a prestigious auditor, a foreign stock exchange, and GDP growth rate. We put forward and substantiated hypotheses about the impact of these factors on the IPO underpricing of companies from the BRICS countries, based on modern scientific studies.

We compiled a sample of 1,141 IPOs of BRICS companies for the period from 2001 to 2018. In addition, we conducted a study for the periods 2001–2008 and 2010–2018, as well as separately for each country. For the period 2001–2018, we revealed a negative impact on IPO underpricing of such factors as IPO volume and a prestigious auditor, and a positive impact of the GDP growth rate and the placement of shares on a foreign stock exchange. For a separate period 2001–2008, we found a negative impact on IPO underpricing of such factors as IPO volume and a prestigious auditor, and a positive impact of the GDP growth rate. For the period 2010–2018, we found a positive impact on IPO underpricing of the deviation of the offer price from the middle of the price range and the placement on a foreign exchange, and a negative impact of a prestigious auditor. Deviation of the offer price from the middle of the price range has a positive effect on the IPO underpricing of Indian companies, while the reputation of the underwriter has a negative effect. As for Chinese companies, we found the negative impact of IPO volume and the prestigious auditor, and the positive impact of the GDP growth rate. We also confirmed the hypotheses about the positive impact of uncertainty about the future company value; the positive impact of the GDP growth rate; and the negative impact of a prestigious auditor on IPO underpricing.

Summing up, in our study, we found that the IPO underpricing in the BRICS countries is influenced to varying degrees by different factors. To maintain the required level of IPO underpricing or its absence, the company must consider the factors affecting it, following the objectives of the IPO and further strategic goals of the company.

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