Central European Economic Journal

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ISSN: 2543-6821 (online)

Journal homepage: http://ceej.wne.uw.edu.pl

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To cite this article

Białek-Jaworska, A., Krawczyk, T. (2019). Corporate bonds or bank loans? The choice of funding sources and information disclosure of Polish listed companies. Central European Economic Journal, 6(53), 262-285.

DOI: 10.2478/ceej-2019-0017

To link to this article: https://doi.org/10.2478/ceej-2019-0017

Central European Economic Journal

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Corporate bonds or bank loans? The choice of funding sources and information disclosure of Polish listed companies

Abstract
The paper aims to find what determines the choice of companies listed on the Warsaw Stock Exchange (WSE) between public debt (corporate bonds) and private debt (bank loans). For this purpose, we estimate logistic regression models and panel models of corporate borrowing determinants to compare the impact of enterprise characteristics on financing with the use of corporate bonds or bank loans. In this study, we are interested in explanatory variables that explain the role of transparency measured by the level of information disclosure; and a risk proxy of the variability of operational cash flows and investment risk (retrieved from generalised auto-regressive conditional heteroscedasticity [GARCH] models estimated on companies' stocks [shares] trading on the WSE).

Keywords
corporate bonds | bank loans | disclosure | cash flow variability | investment risk

JEL Codes
M21, M48

1 Introduction

In this paper, we examine whether the scope of information disclosures and risk exposure significantly influences the choice of debt financing between public and private debts, i.e. between the issuance of bonds and borrowing of bank loan. We focus especially on Poland with the least debt-to-GDP ratio for non-financial corporate in the European Union—only 42%, while this ratio equals 67% in the United States, 74% in the United Kingdom, 165% in Sweden, 189% in Ireland and 201% in Singapore (Dobbs, Lund, Woetzel, & Mutafchieva, 2015). On the other hand, very high levels of finance could have a negative effect on growth, because too much finance increases the frequency of booms and busts; leaves countries ultimately worse off and with lower real GDP growth; and does not impede capital accumulation but leads to a loss of efficiency in investment (International Monetary Fund [IMF], Sahay et al., 2015; Arcand, Berkes, & Panizza, 2012; Philippon & Reshef, 2012, 2013). For Poland, the Financial Development Index is about 0.5, and the relationship between financial development and economic growth rate is not negative yet—as in the cases of Ireland, the United States, and Japan, but it is on the upper top of the inverted parabola (the tip of an inverted U-shaped curve) (IMF, Sahay et al., 2015).

We ask the question what makes public companies issue bonds or, instead, avail debt from the banks: information asymmetry (treated as opposite to information disclosures in financial statements and measured by the scope of the disclosures in the financial statements and on the websites of investor relations) or risk (investment risk, cash flow variability, risk disclosure in the financial statement and in the management report)? The research is interesting because bonds and bank loans are both used to finance a company's development. Thus, the results of this research contribute to knowledge in the field of availability of finance under asymmetrical information and risk. In the period 1999–2014 covered in this study, in the case of Poland, corporate bonds and bank loans

were used for current liabilities and temporary cash shortage (e.g. by members of a business group in the internal capital market), as well as for financing long-term development projects. In the first case, short-term debt securities are an alternative to bank lending and intra-group borrowings, while in the second—companies may float corporate bonds.

The main differences between bonds and a bank loan include the cost of capital, contract flexibility, collateral, quick access to funding and the marketing effect in case of bonds listed on Catalyst.[1] The latter is associated with the image benefits the company gains when appearing on the capital market before the planned initial public offering (IPO). Corporate bonds facilitate diversification of funding, help companies avoid dependence on one bank (or consolidate debt to several banks) and impose less contractual restrictions than those attached to loans, while securing cash despite issuer concentration limits. With no collateral requirements, no draw and repayment schedule, no detailed cash flow planning requirements and the possibility of principal repayment on the maturity date (instead of scheduled payments as with a bank loan), corporate bonds provide flexibility in financing (Gałka, Gontarek, & Kowalski, 2015). The results of the study can be helpful in formulating recommendations for financial institutions, including commercial banks, European Central Bank and Central Bank of Hungary, in the design of corporate financing mechanisms depending on the level of investment risk, variability of cash flow, disclosure and different types of risk exposure disclosed in the management report.

The group of companies that are likely to issue debt includes medical corporations, debt collection agencies and developers, i.e. those with a limited access to bank lending. Issuing bonds is a method to raise funds for intensive investment projects, where insufficient cash flow renders the scheduled loan repayment impossible. In Poland, until 2014, corporate bond issuing has been more expensive than borrowing from a bank (because of a lack of collateral in the case of unsecured bonds) and has had shorter maturity periods (5–7 years for blue chips and 2–3 years for other companies, on an average) (Gałka et al., 2015).

The determinants of a company's choice of financing by issuing corporate bonds or availing bank loans can be explained considering the theory of flotation costs (Diamond, 1984, 1991; Krishnaswami, Spindt, & Subramaniam, 1999; Denis & Mihov, 2003), renegotiation and liquidation (Berlin & Loeys, 1988; Chemmanur & Fulghieri, 1994; Cantillo & Wright, 2000; Esho, Lam, & Sharpe, 2001; Denis & Mihov, 2003) and information asymmetry (influenced by lower financial information and risks disclosure). This paper contributes to prior literature, such as the works of Altunbaş, Kara, and Marques-Ibanez (2010), Gomes and Phillips (2012), Morellecy, Valtaz and Zhdanov (2015).

In order to analyse the determinants of a company's choice of debt funding sources, we estimate logistic regression models and panel models of corporate borrowing determinants to identify the impact of enterprise characteristics depending on the source of financing from corporate bonds or bank loans. For this purpose, we use the STATA 13 statistical software package. In this study, we are interested in explanatory variables that explain the level of information and risk disclosure, variability of operational cash flows, investment risk (retrieved from generalised auto-regressive conditional heteroscedasticity [GARCH] models estimated with the GRETL statistical software package for stocks of listed companies trading on the WSE) and collateral held.

The sample consisted of 223 companies listed on the Warsaw Stock Exchange (WSE), which issued corporate bonds in the years 1999–2014 at least once. Financial data were retrieved from the Notoria database, based on deep cash flow analysis considering the types of financial and investment inflows and outflows. For estimation of investment risk, we used the time series of stock return rates from the period 2011–2014 (each year separately) collected from the Wyborcza.biz service (data are provided by Notoria Serwis S.A.), while data on information and risk disclosures, audit category and free float were manually collected from financial statements, management reports and stock trading published on the websites in the investor relations section.

1 Catalyst is a system for authorisation and trading of debt financial instruments, established on September 30, 2009. It is operated on trading platforms of the Warsaw Stock Exchange (WSE) and BondSpot S.A. The Catalyst bond market consists of four trading platforms: two platforms operated by the WSE - the regulated market formula and the alternative trading system - intended for retail clients; and two markets operated by BondSpot for wholesale customers in the form of a regulated over-the-counter market and an alternative trading system. All of them are intended for Treasury and non-Treasury (municipal, corporate and mortgage bonds) debt instruments.

The paper is structured as follows: a short overview of the corporate bonds market in Poland and the theoretical background are presented in the initial section, followed by a review of empirical studies, with development of research hypotheses. Then, the research design, data and sample are described, and the findings are presented, interpreted and discussed with reference to the literature on the subject. The paper ends with a discussion, summary, conclusions and directions for future research.

2 The corporate bonds market in Poland

The market of corporate bonds has been developing in Poland for 18 years now. Initially, mainly short-term debt securities were issued, and now corporate bonds have a 35% market share. In 2014, the total value of domestic issuance amounted to PLN 21.3 billion, the major bond issues occurring in the energy sector. Corporate bonds with a maturity of >1 year are mainly purchased by banks arranging the issue, whose role often includes that of the purchase guarantor in quasi-loans (as of 31.12.2014, banks took up 44% of all issues), companies considering corporate bonds as sort of an investment (27%), investment fund companies (Towarzystwa Funduszy Inwestycyjnych TFI), open pension funds (Otwarte Fundusze Emerytalne OFE) and insurance companies (~23% in total) (data source: Central Bank of Poland (Narodowy Bank Polski NBP) based on data of 20 banks). The average maturity of bonds is 3 years in Poland, against 5–7 years in Western Europe (Gałka et al., 2015, based on data source: Fitch Polska S.A.). On the international markets, the industry standard is to carry out fixed interest issues, while in Poland, most of the issues carried out are variable rate ones. If there are low interest rates, many companies in Europe or in the United States secure for themselves low-cost capital for the future. Therefore, in the past 3–4 years, the corporate debt market in Europe has witnessed records in issue values (Gałka et al., 2015).

In 2014, the share of corporate bonds in the total value of American companies' financial liabilities was 83%; it was close to 19.5% in the European Union and >12% in Poland (Gałka et al., 2015). The value of corporate bonds issued in the euro zone states accounted for 10% of the EU member states' gross national product (GNP) in 2013, while in Poland, the value of corporate bonds without quasi-loan transactions totalled PLN 42.8 billion, i.e. approximately 2.6% of the country's GNP in 2014. In 2013, this was PLN 32.4 billion. By comparison, the value of bank loans extended totalled PLN 311 billion and PLN 283.3 billion in 2014 and 2013, respectively (Gałka et al., 2015). Over the period between 30th of September 2009, when Catalyst—the first organised debt instruments market—was launched in Poland, and February 2015, the number of corporate bond issuers increased from six to 147. In February 2015, there were only 11 rated bonds on the Catalyst market. Issues lower than 100 million zlotys have nothing to do with rating; either it is unprofitable and useless, or their issuers are not able to calculate the cost of the rating (Gontarek, 2015). Since 2013, a decline in margins has been taking place as a result of low interest rates and the growth in demand caused by the inflow of capital to investment fund companies (TFI). In late 2014, bond margins started with 80 points and reached up to 330 points, at least 100 points lower than the level a year ago. Bond margins are very competitive in relation to bank loans, because the spread on the level of 80–90 points is only 60–70 points higher than that of the treasury bonds (after the swap operation). Due to long-term cooperation and cross-selling, banks can accept lower spreads than those expected by Polish investors, while higher spreads are typically connected with the lack of collateral (Gałka et al., 2015).

Furthermore, in 2014, public offerings of corporate bonds to retail clients grew in number. As a result of the lower interest rate and, the consequently low interests in banks, some of the issuers decided to obtain financing from individuals (PKN Orlen, Echo Investment, BEST SA, PCC Rokita and KRUK). The margins of certain issuances allow individuals to earn more than on a deposit (Gałka et al., 2015). The new Bond Act of 2015 introduces an institution of a collateral administrator for collaterals other than mortgage and registered pledge, as well as an option to institute security following bond issue. Possibilities to issue bonds through a special-purpose company—or with no maturity date and a definition of subordinate debt—were introduced, as were requirements for information disclosure on the website of the issuer. Moreover, the Act specifies the requirements for appraisal of the collateral or mortgage securing the bond obligations (Bond Act, 2015).

3 Literature review

3.1 The choice between private and public debts

Besides the Modigliani and Miller (1958) theorem on capital structure, expanded by Miller (1977) by adding the tax aspect and by DeAngelo and Masulis (1980) with the non-interest tax shield, the trade-off theory and the pecking order theory, the decision whether to choose a private or public debt (a bank loan or corporate bonds) is influenced by the information asymmetry and the company reputation, the agency costs of underfunding and the theory of renegotiation and liquidation. Researchers analysing the choice of funding sources between corporate bonds or bank loans refer to three theories: information asymmetry; flotation cost; and renegotiation and liquidation.

The trade-off theory takes the bankruptcy (financial distress) and agency cost into account. According to the substitution theory, the corporate debt level is determined by the following factors: deviation from the desired leverage, tax shield, bad financial standing and losses of previous years. Furthermore, large companies with substantial fixed assets are more likely to go into debt than small businesses, which rely more on current assets, and are characterised by a higher risk level. According to the pecking order theory (Donaldson, 1961; Myers & Majluf, 1984), corporate funding comes from private sources, i.e. commercial credit and bank loans first, followed by the issuance of debt securities, i.e. bonds, and next by new equity. Private debt is a safer external source of financing as compared with public debt, since it allows for the information asymmetry between the company and the external market to remain on a constant level. Private creditors (e.g. banks), through a better classification of risk and control of corporate activities, are more effective as 'supervisors' than public creditors as a rule, thereby reducing the risk of adverse selection (Leland & Pyle, 1977; Diamond, 1984; Fama, 1985; Boyd & Prescott, 1986). Companies with greater information asymmetry and a higher probability of insolvency will issue a private debt instead of or prior to a public debt. As the information asymmetry decreases, the choice of a debt source will be determined by the cost of transaction, flexibility or credit quality (Diamond, 1991; Rajan, 1992).

According to the information asymmetry theory, companies with more asymmetric information will be borrowing on the private market in order to minimise the cost of capital, thereby enabling the banks to monitor their corporate activities and reducing the temptation of any corruption or misconduct. On the other hand, companies experiencing no problems with information asymmetry will be able to reduce the cost of funding through issuing public debt. Creditors are then more likely to accept a lower rate of return, with less restrictive terms than those imposed by loan contracts. Hence, the borrower's reputation plays a key role when the debt structure decision is made. Well-known companies with good credit ratings will benefit more from using the bond market instruments rather than bank loans. The information asymmetry hypothesis assumes that companies with better reputation and higher credit quality are more likely to choose issuing corporate bonds (a public debt). This relationship is confirmed by Diamond (1984, 1991), Krishnaswami et al. (1999) and Denis and Mihov (2003).

From the flotation cost point of view, the use of public debt involves a significant cost of flotation; therefore, issuing a relatively small public debt will not be cost-effective. Therefore, firms should be using the public debt market only when issuing a substantial debt, so as to benefit from the economies of scale. This conclusion is supported by empirical studies proving the positive correlation between public debt-based financing and the firm size (Smith, 1986; Blackwell & Kidwell, 1988; Houston & James, 1996; Krishnaswami et al., 1999; Esho et al., 2001; Denis & Mihov, 2003).

The renegotiation and liquidation theory addresses the pressure on a debtor forced to renegotiate the debt with many creditors, which takes place in the case of bonds. The problem of coordination may cause companies to experience projects with a negative NPV or a premature closure of projects with a positive NPV. Unlike creditors on the public market, a bank, with its effective borrower-monitoring procedures, is capable of determining whether a project deserves continuation or should be liquidated prematurely (Berlin & Loeys, 1988; Chemmanur & Fulghieri, 1994). Therefore, firms with a high probability of experiencing financial constraints or with a high project liquidation value are more likely to use bank loans than public offering-based funding. This is also supported by empirical studies (Cantillo & Wright, 2000; Denis & Mihov, 2003; Esho et al., 2001), where a negative correlation between the public offering and the probability of borrowers' financial difficulties is suggested.

3.2 Literature review and hypotheses development

Companies with more growth options, higher bargaining power in default and lower volatility of cash flows, in addition to operating in more competitive product markets and facing lower credit supply, are more likely to issue bonds. Moreover, larger firms with greater leverage and an investment rating are more likely to issue bonds (Morellecy et al., 2015).

With the information asymmetry, Tobin's *q*, R&D expenditure and credit spread growth, firms are more likely to choose private placements. On the other hand, large, profitable firms with a high level of financial distress and high cash flow volatility or a lower abnormal annual rate of return in the year preceding the issue are more likely to use public offering. Furthermore, the choice between private and public markets is proved to be sensitive to information asymmetry, risk and market timing for debt, convertibles and, in particular, equity issues (Gomes & Phillips, 2012). European firms with high fixed assets and higher financial leverage are more likely to borrow from the syndicated loan market than from the corporate bond market. Despite having a better reputation on the market, these firms are exposed to a higher financial risk and, as a result, choose private placements. The market-to-book ratio indicating the risk-adjusted investors' expectations on the future cash flows of the firms is positively correlated with the probability of issuing a debt on the bond market. A higher level of capital expenditure leads to public debt funding, as companies with higher capital investment spending, signalling further growth, prefer public debt markets. Larger, more profitable firms are more likely to borrow from syndicated loan and bond markets than from corporate bond markets due to the greater flexibility and the relatively simple process of arranging a loan. Smaller firms, on the other hand, show a positive correlation between the firm size and the probability of issuing both types of debt. Furthermore, the findings confirmed a positive relationship between the short-term debt level and the possibility of borrowing through bond markets. A higher ratio of short-term debt to total debt may expose the firm to more intensive scrutiny by potential creditors and a higher bankruptcy risk, thereby reducing the agency cost. Information asymmetries are expected to be higher in firms with more uncertain growth options, the latter being negatively correlated with the issuance of corporate bonds (Altunbaş et al., 2010).

Public issuers are larger, characterised by lower information asymmetry, less agency problems, higher credit ratings and a higher market-to-book value ratio, which is a measure of the firm's growth opportunities. When comparing loans to public issue, a negative correlation of the probability of bankruptcy, net loss in the year before the placement and the subordinated debt outstanding on the one hand and a positive correlation between the financial leverage and public issuance on the other are observed (Arena, 2011). Public debt issues are more common in larger firms, with a high ratio of fixed assets to total assets, high profitability and a high debt level (Denis & Mihov, 2003). Firms facing a high likelihood of bankruptcy are more likely to borrow from banks, which is consistent with the argument about the role of private lender in renegotiations but inconsistent with theories based on the agency costs of underinvestment. Similar findings are reported by Johnson (2003), who explains that firms solve the problem of underinvestment, preferring debt to equity-based funding—or changing debt maturity instead of issuing bonds. Firms with public debt outstanding are likely to issue public debt in their marginal financing choices. Firms with public debt outstanding have higher financial leverage, a longer-maturity debt and less growth opportunities than firms that rely on bank financing. The main determinant behind choosing the public debt market is issuers' high credit quality, which is consistent with the information asymmetry, borrower's reputation and efficient renegotiation arguments.

4 Hypotheses and research design

We verify the following research hypotheses using (a) the **logit model** on data of 86 non-financial companies listed on the WSE, which, in 2011–2014, issued bonds or borrowed bank loans; and (b) panel regression on data of 223 non-financial companies quoted on the WSE, which—in the years 1999–2014—were financed by public debt (corporate bonds) or private debt (bank credits) at least once:

> (H1A) Companies having a good reputation (credit rating or good credit history) prefer to issue bonds on the debt financing with bank loans.
>
> (H1B) Companies having higher leverage prefer to issue bonds on the debt financing with bank loans. This means that we can expect a positive

correlation between the leverage and the corporate bonds issue, with a negative relationship between the leverage and bank loans borrowed.

(H2) Companies with high growth opportunities are more likely to issue bonds than to borrow bank loans.

(H3) Firms with high liquidation value use bank debt rather than bonds.

(H4) Firms with more information disclosure (in the income statement or the accounting policy) are more likely to substitute bank loans with bonds issue.(H5) Greater extent of information disclosure in the balance sheet increases the probability of bonds issuance.

(H6) Higher investment risk decreases the inclination to issue corporate bonds.

(H7) Companies with a higher level of risk disclosure in their financial statements are more likely to borrow from banks than to issue bonds.

(H8) Firms that face a higher variability of cash flow are more likely to substitute bank loans with corporate bonds issue.

In order to find the determinants of debt finance gained by firms, we estimate panel models of corporate borrowing determinants to compare the significance and direction of the impact of enterprise characteristics depending on the source of financing, namely bank loans or corporate bonds. Future research will be further focussed on the distinction between bonds issuance covered by the bank and corporate bonds subscribed by investors outside the banking sector. In this study, we are interested in explanatory variables that describe the following:

- the level of information and risk disclosure in financial statements and management reports (*cifar, acc_policy, non_acc, disc_income, disc_balance, disc_cf, disc_stockholders, disc_supp, risk disclosure*);
- variability of operational cash flows (*oper_risk*);
- investment risk (retrieved from GARCH models estimated on listed companies stocks trading on the WSE) (*risk*);
- collateral held or potentially possible to provide a collateral for a bank loan (*tangibility*);
- credit rating (*rating*), which measures a good reputation (a good credit history), and financial leverage, which is a measure of capital structure (*leverage*).

4.1 Risk

Despite the widespread opinion that risk associated with bonds is lower than that in case of stocks for example, the evaluation of issuer insolvency risk is highly important for investors. Yet, Polish regulations do not require corporate bonds to be subjected to any mandatory rating, except for the issues targeting foreign markets. Credit risk evaluation is expressed by ratings published by agencies such as Moody's, Standard & Poors, or Fitch for example, following a thorough analysis of the bond issuer's financial standing, growth prospects and risk factors. Ratings increase issuers' credibility and prestige and should affect the cost of capital (bonds' selling price or interest). Securities with a higher rating have lower interest rates or are sold at higher prices. Ratings are assigned upon the issuance of bonds and verified until the bonds' due date. Only 12 out of the public companies analysed in this paper have been assigned credit ratings (ranging from B+ to A–), which means that the bonds assessed are speculative to a certain extent (in case of three companies), represent a medium quality level—although the payment of principal or interest is neither highly secured nor unguaranteed (eight companies)—or show a high credibility of repayment that can be lowered in the future (one company). Certainly, the ratings limit the information asymmetry in the capital market. Denis and Mihov (2003), Arena (2011), Gomes and Phillips (2012), as well as Morellecy et al. (2015) have shown a positive relationship between having a rating and issuing bonds.

Since no rating data were available for most of the analysed firms, alternative risk measures were used in the study:

- investment risk (*risk*);
- standard deviation of the cash flow from operations of the last 5 years or the lower maximum number of years for which data were available (*oper_risk*);
- bankruptcy risk estimated based on Altman *Z*-score (*zscore*, *dum_zscore*) and alternatively based on discrimination function (Rusiecki & Białek-Jaworska, 2015) (*bankruptcy*, *dum_bankruptcy*);
- the level of risk disclosures in the financial statements and management reports on the activities of the company (*risk disclosure*); and
- credit rating according to the methodology used by StockWatch.pl based on Altman's indicator for emerging markets (*rating*).

The investment risk was estimated for the 211 analysed companies based on time series of stock return rates for the years 2011–2014 (in total and each year separately), using autoregressive conditional heteroscedasticity (ARCH), GARCH, exponential GARCH (EGARCH), Glosten–Jagannathan–Runkle GARCH (GJR-GARCH) time series models, in the GRETL software. Thus, 761 econometric models have been estimated based on available data, thereby obtaining unconditional variances, under which we estimated the investment risk (figure available on request). The *q*th-order linear ARCH model [ARCH(*q*)] has been designed for modelling the volatility of the return rate. The model works well for time series where no large lags have to be used and where no significant shocks and innovations occur. ARCH(*q*) includes the following equations:

$$y_t = \sigma_t \varepsilon_t$$

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i y_{t-i}^2$$

where ε_t represents a sequence of independent and identically distributed random variables, whose mean equals zero and variance equals one; and w>0, α_i ³ 0 dla, *i*=1,¼,*q*; and σ_t is the conditional variance of the return rate r_t (Alexander, 2008).

In more complex financial processes, it was necessary to apply large time lags to ARCH(*q*), which made the estimation more difficult. We solved the problem by modifying ARCH(*q*) and its generalisation to GARCH(*p*,*q*). The GARCH (*p*,*q*) equation looks as follows:

$$y_t = \sigma_t \varepsilon_t$$

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i y_{t-1}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2$$

EGARCH (*p*,*q*) was developed by Nelson in 1991. The model expresses clearly the possibility of asymmetry between the rate of return and volatility. The important component of the model, $z_t \equiv \varepsilon_t \sigma_t$, stands for normalised innovation. EGARCH takes the following form:

$$\log(\sigma_t^2) = \omega + \alpha(|z_{t-1}| - E(|z_{t-1}|)) + \gamma z_{t-1} + \beta \log(\sigma_{t-1}^2)$$

For γ <0, negative shocks will have a greater impact on the future volatility than positive shocks of the same magnitude. This effect is observed empirically for return rates remaining within the stock index changes (Alexander, 2008).

GJR-GARCH, developed by Glosten, Jagannathan and Runkle, enables the conditional variance to respond to past negative and positive innovations. The GJR(1,1) model equation takes the following form:

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \gamma \varepsilon_{t-1}^2 I(\varepsilon_{t-1} < 0) + \beta \sigma_{t-1}^2$$

where *I* stands for the indicator function.

When the GJR-GARCH model is estimated with index return rates, γ is positive, which causes volatility to increase proportionally to the incoming positive and negative shocks (Alexander, 2008, pp. 150–151).

In investment risk estimation based on the time series of return rates of the years 2011–2014 on the WSE (the main market and the alternative floor NewConnect) for the 211 companies analysed (out of 223 in the research sample), the average risk equalled 0.046 (the lowest being 0.044 in 2013 and the highest being 0.048 in 2012), the variance achieved a mean level of 0.002 (the lowest was 0.0015 in 2014, and it went up to 0.004 in 2011) and the standard deviation averaged 0.05. Skewness was equal to 4.731 on average (the least being 2.081 in 2014 and going up to 9.025 in 2011), indicating a right-sided asymmetry. Kurtosis had an average of 35.99 (the least was 5.066 in 2014, reaching up to 96.663 in 2011), which indicates a high concentration around the mean and a leptokurtic distribution. The minimum value reached ~0 in 2013, and the maximum equalled 0.803 in 2011, 0.364 in 2012, 0.404 in 2013 and 0.227 in 2014.

4.2 Logistic regression analysis

Determinants of the choice between a bank loan (on the private market) and the issuance of bonds (on the public market) were defined using a logit model for observations of the period 2011–2014. It allows model estimation when the dependent variable is a binary one, taking one of two values (zero or one). According to the methodology of the analysis, the model takes into account the information disclosure indicators proposed by the Center for International Financial

Analysis and Research (CIFAR) (Hope, 2003a, 2003b) for companies listed on the main floor of the WSE:

- **Model 1 (substitutability)**—the response variable takes the value '1', if the company issued bonds in the year covered by the analysis (and **did not contract** any bank loan); and '0', if the company contracted a loan in the same year (but did not issue any bonds);
- **Model 2 (complementariness)**—the response variable takes the value '1', if the company issued bonds in the year covered by the analysis, while contracting a bank loan at the same time; and '0', if the company contracted a loan in the same year or issued bonds (but did not issue those kinds of debt together in the same year);
- **Model 3 (bonds)**—the response variable takes the value '1', if the company issued bonds in the year covered by the analysis; and '0'—otherwise;
- **Model 4 (weak substitutability)**—the response variable takes the value '1', if a company issued bonds in the year covered by the analysis; and '0' if the company borrowed only a bank loan the same year;
- **Model 5 (bank loan)**—the response variable takes the value '1', if a company borrowed a bank loan in the year covered by the analysis; and '0'—otherwise.

Hence, the model can be used for estimating the probability that bonds are issued or a bank loan is contracted, depending on the company characteristics. In a logit model, the probability of success, i.e. the issuance of bonds equals

$$P(Y)=\frac{e^{(\alpha+\beta x)}}{1+e^{(\alpha+\beta x)}},$$

while the chance of success showing the dependence between the probability of success and the probability of a failure equals $e^{\alpha+\beta x}$. A model like this can be estimated using the Highest Probability Method.

5 Data and sample

The research sample consisted of 223 firms listed on the WSE, which issued corporate bonds in the period 1999–2014 at least once. The bond issuers' data were taken from the Notoria database, where data from financial reports of public companies, mainly those listed on the WSE or on NewConnect, are available. The sample selection was based on an analysis of proceeds from bonds and loans shown in the cash flow statements (Table 1). More bond issuers spent the proceeds from the issuance on tangible and intangible fixed assets than investing in financial assets, including affiliates. On average, 44% spent the proceeds from bonds to improve liquidity (including debt roll-up), 70.5% on capital expenditure and 57% on financial assets. Table 2 presents the definitions of variables used in our analyses of the determinants of the choice between corporate bonds and bank loans. Descriptive statistics and correlation matrixes of the variables used in the logistic and panel analyses (for 2011–2014 and 1999–2014 separate) are available on request.[2]

6 Results

Table 3 presents the estimations of the logit models: determinants of substitutability between corporate bonds issue and bank loans borrowing (Model 1) and their weak substitutability (Model 4), their complementariness (Model 2), determinants of bonds issuance (Model 3) and factors influencing bank loans borrowing (Model 5). Based on the estimation from the logit model of the determinants behind firms' choice of corporate bonds or bank loans as a source of financing (the positive coefficient at the *rating* variable in Model 1 of the corporate bonds and bank credit substitutability), hypothesis H1A was verified. Firms enjoying a good reputation (with a higher credit rating and a good history of debt issue, measured by the Altman *Z*-Score for Polish firms, used by StockWatch (2012)) prefer issuing bonds to borrowing from a bank (Hypothesis H1A). Hence, the information asymmetry hypothesis, which assumes that companies with a better reputation and a higher credit quality are more likely to choose issuing corporate bonds (public debt) can be confirmed. This relationship is confirmed by Diamond (1984, 1991), Krishnaswami et al. (1999) and Denis and Mihov (2003). According to the results of logit Model 2 (complementariness), the relation is negative.

The panel models' estimations of bank loan borrowings relative to total assets, performed using the generalised least-squares method (AMGLS), with

2 From the corresponding author abialek@wne.uw.edu.pl.

Tab. 1: Corporate bonds used by companies listed on WSE and outflows in the period 1999–2014

Numbers of companies	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Bonds issue	24	17	14	18	17	18	18	21	35	37	46	59	84	91	97	75
Bank loans without issue bonds	23	38	46	37	42	40	43	57	49	63	69	72	79	88	77	76
Liquidity support by bond issue	6	8	4	7	5	4	6	8	14	11	19	25	39	36	40	38
Financial investments	20	15	14	16	12	13	10	16	25	28	30	44	48	52	56	41
Tangible investments	22	16	13	16	16	15	17	20	30	33	39	48	59	68	63	54

Source: Own analysis based on cash flow statement retrieved from Notoria database.

Tab. 2: Definition of dependent variables (definitions of all variables available on request)

Variable	Definition
y1L	Substitutability of bonds and bank loans—binary variable takes the value 1 if a firm issued bonds in the year *t* (and did not borrow from bank) and 0, if the firm borrowed in a year *t* (but did not issue bonds)
y2L	Complementariness of bonds and bank loans—binary variable takes the value 1 if a firm issued bonds in the year *t*, while contracting a bank loan at the same time; and 0, if the firm contracted a loan in the same year or issued bonds (but did not issue those kinds of debt together in the same year)
y3L	Bond issue—binary variable takes the value 1 if a firm issued bonds in the year *t* and 0—otherwise
y4L	Bank loans—binary variable takes the value 1 if a company borrowed a bank loan in the year covered by the analysis; and 0, if the company did not borrow a bank loan that year
ysub	Weak form of substitutability of bonds and bank loans—binary variable takes the value 1 if a firm issued bonds in the year *t;* and 0, if the firm borrowed only a bank loan in that year *t*
y1p	The size of the bond issue/total assets
y2p	Inflow of bank loan/total assets

Tab. 3: Logistics analysis of the choice between corporate bonds and bank loans

Variable	Model 1 y1L Substitutability		Model 2 y2L Complementariness		Model 3 y3L Bond issue		Model 4 ysub Weak substitutability		Model 5 y4L Bank loans	
	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*
acc_policy	-9.068***	-1.889*	2.799**	0.606*						
	(3.57)	(1.11)	(1.35)	(0.33)						
disc_income	10.812**	2.252*			-4.351**	-0.657**	-4.448***	-1.106***		
	(5.05)	(1.29)			(1.85)	(0.28)	(1.77)	(0.44)		
disc_balance	-7.960*	-1.658#			4.452**	0.673**	5.596***	1.392***		
	(4.59)	(1.20)			(1.83)	(0.27)	(1.85)	(0.46)		
Risk	-67.295**	-14.018#	-6.727	-1.456	-13.154*	-1.987*	-10.947##	-2.722##		
	(31.71)	(10.15)	(5.39)	(1.22)	(7.90)	(1.21)	(7.15)	(1.77)		

Continued **Tab. 3:** Logistics analysis of the choice between corporate bonds and bank loans

Variable	Model 1 y1L Substitutability		Model 2 y2L Complementariness		Model 3 y3L Bond issue		Model 4 ysub Weak substitutability		Model 5 y4L Bank loans	
	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*
Bankruptcy	-0.927**	-0.193***			-0.027**	-0.004**	-0.104**	-0.026**	0.042**	0.009**
	(0.48)	(0.07)			(0.01)	(0.002)	(0.05)	(0.01)	(0.02)	(0.004)
dum bankrupt	9.047***	0.366	-5.381#	-0.387**						
	(3.00)	(0.30)	(3.94)	(0.16)						
Debt	0.542**	0.113#	1.367***	0.296***	0.574***	0.087***	0.473***	0.117***	0.538***	0.111***
	(0.23)	(0.09)	(0.22)	(0.08)	(0.09)	(0.01)	(0.10)	(0.02)	(0.06)	(0.02)
Growth	0.068	0.014	0.093	0.020	0.011	0.002	0.022	0.005	0.092	0.019
	(0.36)	(0.07)	(0.12)	(0.03)	(0.06)	(0.01)	(0.06)	(0.01)	(0.18)	(0.04)
Tangibility	-2.819*	-0.587#	-0.080	-0.017	-0.969#	-0.146#	-0.872	-0.217	0.805	0.166
	(1.74)	(0.45)	(0.84)	(0.18)	(0.77)	(0.11)	(0.76)	(0.19)	(0.95)	(0.19)
oper_risk	4.76e-06***	9.91e-07*							-2.03e-06***	-4.20e-07***
	(1.86e-06)	(0.00)							(5.69e-07)	(0.00)
subs_inv	-0.343***	-0.071*								
	(0.13)	(0.04)								
Maintain liquidity	-0.091***	-0.019##	0.070**	0.015*	0.035**	0.005**				
	(0.04)	(0.01)	(0.04)	(0.01)	(0.016)	(0.002)				
Rating	1.960**	0.408##	-0.575**	-0.124*			-0.242	-0.060	-0.249	-0.051
	(0.83)	(0.27)	(0.28)	(0.07)			(0.24)	(0.06)	(0.23)	(0.05)
Size			-1.26***	-0.273***					-0.218**	-0.045**
			(0.23)	(0.08)					(0.10)	(0.02)
fin_pressures					0.003*	0.0004*	0.004#	0.001#		
					(0.002)	(0.0002)	(0.003)	(0.001)		
riskdisclosure	1.039	0.216			-0.682*	-0.103*	-0.498#	-0.124#	1.072***	0.221***
	(1.01)	(0.23)			(0.37)	(0.05)	(0.37)	(0.09)	(0.33)	(0.07)
public_debt_t1			1.185***	0.259***	1.348***	0.224***	1.578***	0.375***		
			(0.35)	(0.09)	(0.32)	(0.06)	(0.31)	(0.07)		
Auditor	-1.591*	-0.328#			-1.400***	-0.203***	-1.041***	-0.252***		
	(0.97)	(0.25)			(0.39)	(0.05)	(0.39)	(0.09)		
freefloat	-4.413**	-0.919#			-1.167#	-0.176#				
	(2.23)	(0.65)			(0.84)	(0.13)				
tax_shield	0.558#	0.116##			0.020	0.003				
	(0.40)	(0.07)			(0.02)	(0.002)				
Age					-0.062##	-0.009##	-0.063*	-0.016*		
					(0.04)	(0.01)	(0.04)	(0.01)		

Continued **Tab. 3:** Logistics analysis of the choice between corporate bonds and bank loans

Variable	Model 1 y1L Substitutability		Model 2 y2L Complementariness		Model 3 y3L Bond issue		Model 4 ysub Weak substitutability		Model 5 y4L Bank loans	
	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*	Coeff	*dy/dx*
rollover_debt	2.023**	0.421*								
	(0.93)	(0.22)								
Liquidity					-0.019	-0.003				
					(0.02)	(0.002)				
real_estate					-0.336*	-0.051*				
					(0.18)	(0.03)				
tax_saving			-0.233#	-0.050						
			(0.16)	(0.05)						
long_debt			-0.760#	-0.164						
			(0.58)	(0.13)						
_cons	-4.804##		1.021		-4.372***		-4.728***		-1.236	
	(3.36)		(1.62)		(1.34)		(1.52)		(1.12)	
Pr(y) (predict)	0.704		0.317		0.185		0.463		0.708	
Correct classif	88.50%		82.46%		81.49%		76.21%		88.08%	
LR	87.3***		139.6***		188.96***		112.1***		205.9***	
Adjusted count R^2:	0.667		0.478		0.519		0.226		0.634	
Pearson	chi-squared (94)	67.0	chi-squared (255)	255.3	chi-squared (317)	261.6	chi-squared (255)	247.5	chi-squared (335)	335.5
Prob.		0.984		0.482		0.990		0.620		0.483
LR chi-squared (2)	87.57***		139.58***		188.96***		112.42***		207.95***	
Log likelihood	-29.03		-101.25		-128.79		-129.93		-113.09	
Pseudo R^2	0.601		0.408		0.423		0.302		0.479	
_hat	1.046*** (0.24)		0.999*** (0.15)		1.001*** (0.12)		1.012*** (0.13)		1.035*** (0.13)	
hatsq	0.034 (0.05)		-0.001 (0.06)		0.002 (0.05)		0.039 (0.07)		-0.077 (0.05)	
cons	-0.063 (0.37)		0.001 (0.20)		-0.003 (0.18)		-0.056 (0.18)		0.234 (0.26)	

Significant at: *** 1%, **5%, *10%, #15% and ##20%.

the panel data autocorrelation and heteroscedasticity taken into account, as well as using the fixed effects and the random effects estimator (Table 5), show that firms with a better reputation and a higher credit quality (with credit rating from BB to B– (*rating 2*)) borrow less bank loans relative to total assets, while companies with a worse reputation and a lower credit quality (with credit rating from CCC to D (*rating 1*)) borrow relatively more bank loans in proportion to total assets. On the contrary, the findings point the positive relation between the *rating 2* variable (credit rating from BB to B–) and the bonds issue rescaled by total assets in the panel model estimated with fixed effects estimator only (Table 4). At the indicated limits of interpretation, the findings support Hypothesis H1A.

For the *rating 3* variable, there is an insignificant and very low impact on the bank loans borrowings-to-total assets ratio (Table 5) and negative correlation with bonds issue relative to total assets, however, only under fixed-effects estimation (Table 4). These results for the most profitable companies, with the highest credit rating, are confirmed also by the negative relationship between profitability (return on assets—*roa*) and the dependent variable for panel models with better ratings (*rating 2* and *rating 3*) of regression estimated with the use of the fixed-effects estimator and the generalised least-squares AMGLS estimator, with the panel data autocorrelation and heteroscedasticity taken into account. The results show that more-profitable companies borrow less bank loans, which is in accordance with the pecking order theory (Donaldson, 1961; Myers & Majluf, 1984). This negative correlation is confirmed by Bougheas, Mizen and Yalcin (2004), Ghosh and Sensarma (2004), Alonso, Iturriaga, Sanz and Gonzalez (2005), Dewaelheyns and Van Hulle (2007), Cole (2008, 2010), Jiménez, Ongena, Peydró and Saurina (2010) and Białek-Jaworska and Nehrebecka (2014) for Polish firms' long-term bank loan borrowings and short-term liabilities of Polish small- and medium-sized enterprises (SMEs) due to bank loans.

On the other hand, based on the estimation of the panel models of determinants behind firms' decisions to issue bonds, it was possible to positively verify Hypothesis H1B, owing to a positive correlation between the leverage and the level of corporate bonds issue scaled by total assets for all models (fixed effects [FE], random effects [RE] and AMGLS taking autocorrelation and heteroscedasticity into account in panel data). By comparison, panel model estimations by the FE estimator of companies' bank loan financing determinants indicate a negative correlation with the financial leverage. This proves that firms with higher leverage prefer issuing bonds to borrowing from banks (**H1B**). Similar results are reported by Denis and Mihov (2003), Arena (2011) and Morellecy et al. (2015).

As regards the verification of Hypothesis H2, which assumes that firms with high growth opportunities are more likely to issue bonds than to borrow from banks, the estimation of the logit models does not show any significant correlation in any of the estimated models. Only the estimation of panel models of determinants of the firm's financing by corporate bonds issue, by an estimator, taking the panel data heteroscedasticity and autocorrelation into account, revealed a positive correlation with growth opportunities on a 20% significance level (Table 4). This supports the conclusion that firms with greater growth opportunities issue more corporate bonds. The estimation of panel models of firm's bank loan financing determinants by an estimator, taking the panel data heteroscedasticity and autocorrelation into account, revealed a positive correlation with growth opportunities on a 1% significance level (Table 5). This supports the conclusion that firms with greater growth opportunities borrow more from banks, with higher coefficients (Table 5) than in the case of coefficients in panel models of corporate bonds issuance determinants (Table 4). This does not confirm Hypothesis H2, because companies with high growth opportunities are more likely to borrow bank loans than issue bonds. This gives the reasons for rejecting Hypothesis H2.

The estimation of the logit model of determinants behind firms' choice of corporate bonds or bank loans as a source of financing (the corporate bonds and bank credit substitutability—Model 1) and determinants behind firms' decisions to issue debt securities (Model 3) was used to verify Hypothesis H3, based on the negative coefficient for the tangible assets-to-total assets ratio. It was proved that firms with a high liquidation value (tangibility) borrow from banks more often than issue bonds (Model 1—substitutability) and issue corporate bonds less often (Model 3—bonds issue). Hypothesis H3 is additionally supported by the estimation of the panel model of firms' determinants to use bank loans by an estimator that takes into account heteroscedasticity and autocorrelation in panel data. A strongly significant correlation between the share of tangible assets in total assets and the

Tab. 4: Results of panel analysis of determinants of corporate bonds issue

y1p	**FE**	**RE**	**AMGLS**	**FE**	**RE**	**AMGLS**
y4l	-0.0816***	-0.0709***	-0.0422***	-0.0819***	-0.0714***	-0.0425***
	(0.0119)	(0.0103)	(0.0038)	(0.0119)	(0.0103)	(0.0039)
Risk	-0.0094	0.0894	0.0608*	-0.0250	0.0806	0.0592*
	(0.0822)	(0.0742)	(0.0347)	(0.0823)	(0.0741)	(0.0346)
Leverage	0.0368***	0.0277**	0.0114**	0.0357**	0.0256**	0.0102*
	(0.0142)	(0.0113)	(0.0056)	(0.0143)	(0.0115)	(0.0055)
dum_zscore	0.0209##	0.0266**	0.0063*	0.0219##	0.0260**	0.0060*
	(0.0139)	(0.0118)	(0.0035)	(0.0139)	(0.0118)	(0.0035)
Debt	0.0165***	0.0129***	0.0070***	0.0167***	0.0130***	0.0070***
	(0.0014)	(0.0012)	(0.0005)	(0.0014)	(0.0016)	(0.0005)
Growth	-0.0015**	0.0004	**0.0009**#	-0.0013**	0.0004	**0.0009**#
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Tangibility	0.0913**	-0.0057	-0.0050	0.0836**	-0.0076	-0.0055
	(0.0418)	(0.0195)	(0.0045)	(0.0418)	(0.0196)	(0.0047)
subs_inv	0.0037***	0.0007	-0.0002	0.0037***	0.0007	-0.0001
	(0.0013)	(0.0010)	(0.0003)	(0.0013)	(0.0010)	(0.0003)
Rating_2	0.0135***	0.0030	-0.0002			
	(0.0050)	(0.0044)	(0.0016)			
Rating_3				-0.0081**	-0.0030	-0.0006
				(0.0034)	(0.0027)	(0.0008)
public_debt_t1	-0.0137*	0.0024	0.0125***	-0.0133##	0.0019	0.0120***
	(0.0082)	(0.0075)	(0.0030)	(0.0082)	(0.0075)	(0.0030)
fin_pressures	0.00001	-0.0002	-0.0002***	-0.00002	-0.0003	-0.0002***
	(0.0003)	(0.0002)	(0.00003)	(0.0003)	(0.0002)	(0.00004)
_cons	-0.0511***	-0.0117#	-0.0026#	-0.0310**	-0.0041	-0.0011
	(0.0135)	(0.0105)	(0.0023)	(0.0148)	(0.0121)	(0.0035)
Number of observations	761	761	761	761	761	761
Number of groups	208	208	208	208	208	208
R^2 within group	0.2604	0.2164		0.2584	0.2182	
R^2 between groups	0.0251	0.1069		0.0307	0.1072	
R^2 overall	0.0908	0.1500		0.0963	0.1507	
corr(u_i, Xb)		-0.4480			-0.4384	
F(11,542) test		17.35***			17.17***	
F(207,542) test that all u_i=0		2.84***			2.82***	
Wald test		151.47***	369.16***		152.42***	361.24***
Sargan–Hansen test of over-identifying restrictions		127.022***			124.156***	
Hausmann test		109.98***			107.86***	

Continued **Tab. 4:** Results of panel analysis of determinants of corporate bonds issue

y1p	FE	RE	AMGLS	FE	RE	AMGLS
Breusch–Pagan Lagrangian multiplier test for random effects		54.87***			55.84***	
Wooldridge test for autocorrelation in panel data		3.728 0.0550			3.756 0.0541	
Modified Wald test for groupwise heteroscedasticity in fixed-effect regression model	-208***			-208***		

Significant at: ***1%, **5%, *10%, #15% and ##20%.

Tab. 5: Results of panel analysis of determinants of bank loans borrowings

y2p	FE	RE	AMGLS	FE	RE	AMGLS	FE	RE	AMGLS
y1l	-0.1449***	-0.1196***	-0.0757***	-0.1416***	-0.1172***	-0.0750***	-0.1422***	-0.1181***	-0.0779***
	(0.0239)	(0.0206)	(0.0053)	(0.0240)	(0.0206)	(0.0052)	(0.0238)	(0.0206)	(0.0052)
Risk	0.0303	-0.0347	0.0190	0.0313	-0.0146	0.0233	-0.0042	-0.0535	0.0057
	(0.1552)	(0.1295)	(0.0340)	(0.1555)	(0.1295)	(0.0328)	(0.1555)	(0.1309)	(0.0341)
Leverage	-0.0712**	-0.0017	0.0048	-0.0743***	-0.0031	-0.0002	-0.0775***	-0.0113	-0.0019
	(0.0282)	(0.0186)	(0.0076)	(0.0283)	(0.0192)	(0.0084)	(0.0281)	(0.0191)	(0.0074)
market_to_ book	1.04e-06	1.33e-06	6.23e-07	6.42e-07	1.34e-06	7.08e-07#	1.82e-07	9.06e-07	2.57e-07
	(2.18e-06)	(1.41e-06)	(5.36e-07)	(2.22e-06)	(1.43e-06)	(5.26e-07)	(2.19e-06)	(1.43e-06)	(5.17e-07)
roa	-0.2597**	0.0618	-0.0538**	-0.2364**	0.0729	-0.0533*	-0.2332*	0.0990	-0.0238
	(0.1205)	(0.0998)	(0.0269)	(0.1212)	(0.1017)	(0.0279)	(0.1198)	(0.1005)	(0.0256)
dum_zscore	0.0154	-0.0146	-0.0026	0.0174	-0.0136	-0.0033	0.0239	-0.0138	-0.0059#
	(0.0294)	(0.0218)	(0.0053)	(0.0296)	(0.0219)	(0.0052)	(0.0295)	(0.0218)	(0.0051)
Debt	0.0148***	0.0123***	0.0090***	0.0145***	0.0120***	0.0088***	0.0148***	0.0122***	0.0091***
	(0.0020)	(0.0015)	(0.0004)	(0.0020)	(0.0015)	(0.0004)	(0.0020)	(0.0015)	(0.0004)
Growth	0.0017#	0.0013	0.0014***	0.0017#	0.0013	0.0013***	0.0021##	0.0014	0.0015***
	(0.0013)	(0.0012)	(0.0003)	(0.0013)	(0.0012)	(0.0003)	(0.0013)	(0.0012)	(0.0003)
Tangibility	-0.1092	-0.0104	0.0129##	-0.1066	-0.0144	0.0132##	-0.1246##	-0.0213	0.0200***
	(0.0792)	(0.0317)	(0.0084)	(0.0793)	(0.0321)	(0.0083)	(0.0793)	(0.0319)	(0.0080)
oper_risk	1.17e-07	1.76e-09	6.63e-09	1.11e-07	9.22e-10	6.34e-09	1.13e-07	5.15e-09	8.36e-09
	(1.26e-07)	(3.63e-08)	(1.65e-08)	(1.26e-07)	(3.65e-08)	(1.70e-08)	(1.26e-07)	(3.65e-08)	(1.55e-08)
long_debt	0.0279	0.0086	-0.0006	0.0338	0.0105	0.0007	0.0417##	0.0153	0.0035
	(0.0265)	(0.0193)	(0.0047)	(0.0271)	(0.0196)	(0.0047)	(0.0268)	(0.0195)	(0.0046)
subs_inv	-0.0042*	-0.0021#	-0.0012**	-0.0040*	-0.0019#	-0.0013**	-0.0041*	-0.0019#	-0.0012***
	(0.0024)	(0.0016)	(0.0005)	(0.0024)	(0.0017)	(0.0005)	(0.0024)	(0.0016)	(0.0005)
Rollover	-1.65e-09	-1.41e-09	-1.13e-09**	-1.68e-09	-1.36e-09	-1.13e-09**	-1.71e-09	-1.38e-09	-1.2e-09**
_debt	(2.51e-09)	(2.33e-09)	(5.41e-10)	(2.52e-09)	(2.34e-09)	(5.56e-10)	(2.51e-09)	(2.33e-09)	(5.94e-10)
Age	-0.0083##	-0.0064***	-0.0030***	-0.0082##	-0.0063***	-0.0031***	-0.0098*	-0.0065***	-0.0036***
	(0.0053)	(0.0017)	(0.0005)	(0.0053)	(0.0017)	(0.0005)	(0.0053)	(0.0017)	(0.0005)

Continued **Tab. 5:** Results of panel analysis of determinants of bank loans borrowings

y2p	FE	RE	AMGLS	FE	RE	AMGLS	FE	RE	AMGLS
public	-0.0151	-0.0076	-0.0042	-0.0180	-0.0093	-0.0044	-0.0168	-0.0111	-0.0091***
debt_t1	(0.0157)	(0.0131)	(0.0036)	(0.0157)	(0.0132)	(0.0035)	(0.0155)	(0.0131)	(0.0034)
rating_2	-0.0116#	-0.0126*	-0.0070***						
	(0.0096)	(0.0076)	(0.0022)						
rating_3				-0.0044	0.0004	0.0007			
				(0.0067)	(0.0048)	(0.0013)			
rating_1							0.0558***	0.0294*	0.0142***
							(0.0240)	(0.0169)	(0.0043)
_cons	0.0917*	0.0563**	0.0243***	0.0931*	0.0503*	0.0220***	0.0861*	0.0478*	0.0245***
	(0.0535)	(0.0271)	(0.0071)	(0.0550)	(0.0286)	(0.0074)	(0.0529)	(0.0270)	(0.0069)
No of observations	761	761	752	761	761	752	761	761	752
of groups	208	208	199	208	208	199	208	208	199
R^2 within group	0.1573	0.1279		0.1556	0.1266		0.1634	0.1329	
R^2 between groups	0.0302	0.1222		0.0293	0.1165		0.0298	0.1156	
R^2 overall	0.0778	0.1248		0.0765	0.1210		0.0777	0.1237	
corr(u_i, Xb)	-0.3248			-0.3204			-0.3511		
F(16,537)	6.26***			6.19***			6.56***		
F-test that all u_i=0									
F(207, 537)	1.81***			1.82***			1.85***		
Wald test chi-squared		106.02***	631.16***		102.91***	629.24***		106.37***	808.66***
Sargan–Hansen test of over-identifying restrictions									
chi-squared		43.653***			43.550***			45.921***	
Hausman test of over-identifying restrictions									
chi-squared (13)		41.77***			41.59***			43.76***	
Breusch–Pagan Lagrangian multiplier test for random effects									
chibar²(01)		28.32***			28.89***			29.69***	
Wooldridge test for autocorrelation in panel data									
F(1,187)		-208***			-208***			-208***	
Modified Wald test for groupwise heteroscedasticity in fixed-effect regression model									
chi-squared (211)		8.755***			8.610***			8.505***	

Significant at: ***1%, **5%, *10%, #15% and ##20%.

bank loan value scaled by total assets was proved (Table 5—the model with the *rating_1* variable). At the same time, the panel model of determinants of the corporate bonds issue divided by total assets did not show any statistically significant correlation with the tangibility variable, which would reflect the share of tangible assets playing the role of collateral (AMGLS models in Table 4). This shows that there is no basis for rejecting Hypothesis H3, according to which firms with a higher tangibility are more likely to borrow from banks than to issue bonds.

The results of logistic regression show that firms with a higher information asymmetry (i.e. disclosing less information), in terms of detailed disclosures in the profit-and-loss account, are more likely to issue debt securities than firms disclosing more information in this respect (Model 3—issue of bonds; and Model 4—weak substitutability between bonds and a new debt in a bank); however, at the same time, they are less likely to substitute bank loans by corporate bonds issuance (Model 1—substitutability). In other words, more information disclosure in income statement translates into companies' greater inclination to substitute bank loans with bonds issue (Model 1) (which is in accordance with Hypothesis H4), while discouraging the bond issue (Models 3 and 4), however with lower marginal effects. With a higher information asymmetry associated with a lower level of disclosure in the accounting policy, the substitution between corporate bonds issuance and borrowing from banks is more likely (Model 1). These results of Model 1 reject Hypothesis H4 in the case of disclosure in the accounting policy. However, a higher level of disclosure in the accounting policy increases the probability of private and public debt complementariness (bank credit and bonds, respectively).

The greater the information asymmetry in terms of the balance sheet details, the lower is the probability of corporate bonds issue (Models 3 and 4). Yet, a positive impact of lower information disclosures in the scope of the balance sheet details (this means higher information asymmetry) on the probability of debt securities issue and the bank credit substitutability is observed on a low significance level (Model 1). Model 3 shows that a greater extent of information disclosure in the balance sheet increases the probability of bonds issuance by 67.26 pp. This confirms Hypothesis H5.

Results for the *risk* variable in Models 1, 3 and 4 confirm Hypothesis H6, which states that a higher investment risk decreases firms' inclination to use public debt incurred as a result of issuing corporate bonds. An analysis of the determinants behind the public companies' inclination to issue bonds in the years 2011–2014, with the investment risk taken into account (Model 3), shows a negative effect of investment risk on the decision to issue public debt. With the growth of the investment risk by 1%, the probability of issuing corporate bonds decreases by 198.72 pp. (Model 3 in Table 3). However, firms that experience a higher investment risk (*risk*) issue more corporate bonds in relation to total assets (Table 4).

A higher probability of insolvency decreases firms' inclination to use public debt incurred as a result of issuing corporate bonds (variable *bankruptcy* in Models 3 and 4; and variable *dum_bankrupt* in Model 2), while increasing the probability of financing the business with private debt in the form of bank loans (Model 5). Similar tendencies are reported by Diamond (1991) and Rajan (1992). Firms facing the risk of bankruptcy (*dum_bankrupt*) are more likely to use one source of debt financing (bond issue or bank loan) than to combine funding from a private debt (bank loan) and a public debt (bonds) (Model 2). In the case of substitutability between corporate bonds and bank loans, the negative impact of probability of economic failure (variable *bankruptcy* in Model 1) is reduced by the positive influence of the dummy variable (*dum_bankrupt*) indicating whether the value of the discrimination function for the purpose of bankruptcy prediction (variable *bankruptcy*) is >0.5 (for the case of high probability of economic failure). The results for this dummy variable (*dum_bankrupt*) show that for companies that are likely to go bankrupt, the complementary use of bank debt and public debt (bonds issue) is less likely than their substitutability (Models 1 and 2 in Table 3). However, according to the results presented in Table 4 (panel models), firms exposed to a higher probability of bankruptcy (*dum_zscore*) issue more corporate bonds in relation to total assets. Facing a higher variability of cash flow, firms are more likely to substitute bank loans with the issue of debt securities (Model 1) and are discouraged from borrowing from banks (Model 5). These findings are consistent with our assumption formulated in Hypothesis H8.

Firms investing in their subsidiary companies substitute private debt with public debt less often (Model 1 in Table 3), while they borrow less bank loans relative to total assets (Table 5). Panel model estimation results show that parent companies issue more corporate bonds (relative to total assets) in order

to finance investments in their subsidiary companies; however, these results are obtained only with the use of the fixedeffects estimator (Table 4).

The need to raise borrowed capital in order to improve liquidity increases firms' inclination to issue corporate bonds (Models 2 and 3) but decreases the probability of the private and public debt substitution (Model 1). Companies that need more debt-based financing show higher positive marginal effects of obtaining funds from both channels: bank lending and corporate bonds (Model 2) than from the issuance of bonds only (Model 1).

Larger firms are less likely to borrow from banks (Models 2 and 5), and this may be caused by the bonds issue scale effect resulting from the high fixed cost of issuing debt securities (according to the flotation costs theory). The combination of both sources of financing (complementariness of bonds and bank loans) is more often used by smaller firms **(**Model 2). This may be because of lack of sufficient tangibility, which could play the role of a collateral.

Firms burdened with a higher debt maturity (*fin_pressures* equals to the relation of short-term debt to long-term debt) are more willing to issue debt securities (Models 3 and 4). However, they issue less corporate bonds in relation to total assets than the bond issuers that are not experiencing financial pressure (Table 4).

Firms with a higher level of risk disclosure in their financial statements are more likely to borrow from banks (Model 5) than to issue bonds (Models 3 and 4). This is in accordance with Hypothesis H7. Firms whose financial statements are examined by the 'Great Four' statutory auditors are less likely to use public debt (Models 1, 3 and 4) than to borrow from a bank. Similarly, firms with a more dispersed shareholder structure (*free float*) are less likely to issue bonds (Models 1 and 3).

Any previous experience in the corporate bonds issue increases the probability of another issue of public debt in the current period (Models 2, 3 and 4), in addition to increasing the size of bonds issuance in relation to total assets (according to the results of panel models presented in Table 4). Additionally, these conclusions are supported by the negative coefficient at the *public_debt_t-1* dummy variable in the panel analysis of financing by bank loans, which included the *rating_1* variable (Table 5). Preliminary analysis of bank loan and bond complementariness (Model 2) shows that the fact of having previous experience with bonds increases the chance for obtaining funds from both sources concurrently by 25.9 pp. A higher long-term debt reduces the chance for further private and public lending (Model 2) by 16.4 pp, as compared with companies failing to use both instruments concurrently (but at a low level of significance). An analysis of factors determining companies' inclination to issue bonds shows that the fact of having issued bonds in the previous year increases the probability of the next issue in the current year by 22.39 pp. (Model 3). This outcome is consistent with the results reported by Denis and Mihov (2003).

Younger firms (with a shorter listing history) are more likely to use bond-based funding **(**Models 3 and 4 in Table 3**)** and less likely to use private and public debt substitution (Model 4). These companies, listed on the WSE for a shorter period, borrow more from banks in proportion to their total assets (Table 5). Debt rollover, on the other hand, increases the probability of substituting bank credit with corporate bonds issue (Model 1). The results allow the conclusion that debt-based financing is a stable strategy, since a higher rollover increases the probability of higher substitution of bank loans with public debt by 42.14 pp. (Model 1). Companies rolling over their debt (i.e. issuing bonds to pay their existing debts) borrow less from banks in proportion to their balance sheet total (Table 5). Real property investments are more often financed with a bank loan than with the debt securities issue (Model 3) due to the possibility of establishing collateral.

The variable *debt*, which reflects the value of debt financing (bonds issue and/or bank credit), plays the role of a control variable. In all logit models, as well as in private debt (bank loan) financing value and public debt (bonds issue) financing value (scaled by assets) models (Tables 4 and5, the *debt* control variable shows a positive correlation with the response variable (the dependent variable in panel models). The panel models estimations performed using the AMGLS, with the panel data autocorrelation and heteroscedasticity taken into account, as well as using the FE and RE estimators, show the substitutability between public debt (share of corporate bonds issue in total assets) and the borrowing of private debt (bank loan) during the same year (the *y4l* binary variable) (Table 4). Similarly, the panel models for bank loans (Table 5) show the negative relation with use of public debt without private debt in banks (the *y1l* binary variable, which indicates the substitutability of corporate bonds and bank loans).

Tab. 6: Results of panel analysis of determinants of bonds issues in the period 1999–2014

Variable	RE random effects	Prais-–Winsten regression
y2p	-0.0276*	-0.0378
	(0.0150)	(0.0316)
Size	-0.0077***	-0.0070***
	(0.0022)	(0.0026)
Leverage	0.0250***	0.0308***
	(0.0088)	(0.0088)
market_to_book	8.00e-07##	7.48e-07 ***
	(5.51e-07)	(2.10e-07)
dum_zscore	0.0148**	0.0216**
	(0.0067)	(0.0101)
Debt	0.0085***	0.0093***
	(0.0007)	(0.0004)
Tangibility	-0.0582***	-0.0574***
	(0.0159)	(0.0151)
Liquidity	0.0001	0.0001***
	(0.0001)	(0.00003)
tang_investment	0.0016#	0.0017#
	(0.0012)	(0.0013)
subs_inv	0.0029***	0.0024***
	(0.0007)	(0.0009)
Maintainliquidity	0.0001**	0.0001#
	(0.00004)	(0.0001)
tax_shield	0.0012***	
	(0.0004)	
Age	-0.0019**	-0.0020*
	(0.0008)	(0.0012)
public_debt_t1	0.0319***	0.0219#
	(0.0062)	(0.0157)
Growth		-3.91e-06***
		(1.38e-06)
_cons	0.0641***	0.0534***
	(0.0204)	(0.0146)
Number of observations	2154	
Number of groups	223	
Obs. per group: minimum	3	
Average	9.6592	
Maximum	16	
R^2	0.1250	

Continued **Tab. 6:** Results of panel analysis of determinants of bonds issues in the period 1999–2014

Variable	RE random effects	Prais-–Winsten regression
Wald chi-squared(14)	297.01***	4712.70***
Modified Wald test for groupwise heteroscedasticity in fixed-effect regression model	chi-squared (223) = 7.5e+05***	
Wooldridge test for autocorrelation	*F*(1, 222) = 6.437**	
Breusch and Pagan Lagrangian multiplier test for random effects	chibar2(01) = 499.87***	

Significant at: ***1%, **5%, *10%, #15% and ##20%.

A panel analysis (Table 6) of determinants behind the size of bonds issue (scaled by total assets) performed on a sample of 2154 observations for 223 companies (an unbalanced panel) shows the substitutability of public and private debt, i.e. the issue of bonds and using a bank loan (in the RE model). In the model estimation performed using the Prais–Winsten regression for correlated panels with corrected standard errors (PCSEs), the coefficient remains negative, but the significance of the variable worsens (0.231). The analysis shows that younger (*age*) and smaller (*size*) firms are more interested in issuing bonds. Firms with greater growth opportunities issue less corporate debt securities.

Considering that the sample is limited to firms issuing debt securities and/or borrowing from banks to raise capital, one may suppose that firms are more likely to borrow from banks than to issue corporate bonds as their growth opportunities (*growth opportunity*) increase (which seems to indicate that there are reasons for rejecting Hypothesis H2). On the other hand, the negative coefficient of the *tangibility* variable shows that there are no grounds for rejecting Hypothesis H3, according to which firms with a high tangibility (liquidation value that is measured by the share of tangible assets in total assets) are more likely to borrow from banks than to issue bonds (Table 6). Similarly, the results of logit Models 1 and 3 reveal a negative correlation between the response variable (the bonds issuance and bank credit substitutability (Model 1) and the issuance of debt securities (Model 3)) and *tangibility*, although this variable becomes significant only on the 20% significance level. This shows that there were no grounds for rejecting Hypothesis H3, according to which firms with a high tangibility (the share of tangible assets in total assets) are more likely to borrow from banks than to issue bonds.

Furthermore, the results obtained on a large panel sample show that companies with higher *leverage*, a higher relation of the market value-to-the book value (*market-to-book ratio*), but facing a higher bankruptcy risk (*dum_zscore*), with greater financial needs (*debt*) and a higher liquidity (*liquidity*), as well as those investing in subsidiary companies (*subs_inv*), issue more bonds (relative to total assets) (Table 6).

7 Conclusions and discussion

The considerations presented in this paper contributed to the achievement of the objective formulated in the Introduction section, by way of comparing the determinants of firms' use of corporate bonds issuance and bank credit as potentially alternative sources of financing both their day-to-day business and investments as well, in the light of information asymmetry, the flotation cost theory and the renegotiation-and-liquidation theory. According to the pecking order theory, private debt is a safer external source of financing as compared with public debt, since it allows for the information asymmetry between the company and the external market to remain on a constant level. According to this theory, firms with a higher information asymmetry level (less information disclosure) and a higher probability of insolvency should seek financing on the private market, e.g. by way of borrowing from banks, instead of or prior to raising capital on the public market, e.g. in the form of bonds. This is confirmed by Model 5 of

the logistic regression, showing a positive correlation between firms' decisions to borrow from a bank and the probability of bankruptcy. Less information disclosure in the accounting policy reduces the probability of the public and private debt complementariness (Model 2), while greater information asymmetry in the balance sheet disclosure reduces the probability of corporate bonds issuance (Model 3) (confirmation of Hypothesis H5) and of a weak substitutability between the debt securities issuance and borrowing from banks (Model 4). Our findings confirm that companies with more information disclosure in the income statement are more likely to substitute bank loans with bonds issue (Hypothesis H4); however, the results reject this relation in the scope of accounting policy disclosure.

Hypothesis H1A, according to which firms with a good reputation (a higher credit rating and a good history of debt issue) prefer issuing bonds to borrowing from banks, was proved. This supports the information asymmetry hypothesis, which assumes that companies with a better reputation and a higher credit quality are more likely to choose issuing corporate bonds. This relationship is confirmed by Diamond (1984, 1991), Krishnaswami et al. (1999) and Denis and Mihov (2003). Furthermore, the correlation reported earlier by Denis and Mihov (2003), Arena (2011) and Morellecy et al. (2015), namely that firms with a higher financial leverage prefer issuing bonds to borrowing from banks (Hypothesis H1B), was confirmed for the companies listed on the WSE too based on comparison of the coefficients at the *leverage* variable in the panel models of bonds issue determinants (Table 4) with the coefficients at the *leverage* variable in the panel models of bank loans borrowings determinants (Table 5). We show that higher investment risk decreases firms' inclination to issue corporate bonds (Hypothesis H6), while higher level of risk disclosure in the financial statements increases the probability of borrowing from banks than bonds issue (Hypothesis H7). Our results confirm also that companies that face a higher variability of cash flow are more likely to substitute bank loans with corporate bonds (Hypothesis H8) and are discouraged from borrowing from banks.

Firms with greater growth opportunities were proved to issue more corporate debt securities (however, at a low 20% level of significance) while borrowing more from banks (at the 1% significance level). The *growth* variable was insignificant in th elogit models. It seems that Hypothesis H2 should be rejected. Earlier studies, namely Arena (2011), Altunbaş et al. (2010), Gomes and Phillips (2012) and Morellecy et al. (2015), argued that firms with high growth opportunities are more likely to issue bonds than to borrow from banks.

Based on the estimations of logistic regression of the bonds and bank credit substitutability (Model 1), the bonds issuance determinants (Model 3) and the panel model of the bank loan size determinants (Table 5), Hypothesis H3, according to which firms with higher *tangibility* (the share of tangible assets in total assets) are more likely to borrow from banks than to issue bonds, was confirmed. In fact, according to the renegotiation and liquidation theory, tangible assets offer a much easier way of collateralising bank lending, since they are subjected to a stricter monitoring by banks, thus helping to reduce the inefficient liquidation process. The negative correlation of this variable with the issuance of bonds is consistent with the results reported by Esho et al. (2001), Altunbaş et al. (2010) and Morellecy et al. (2015).

Raising capital by way of issuing corporate bonds is a cheaper and more flexible source of funding than bank loans, since no collateral is required here, the purpose of bonds issuance does not need to be declared and the funds raised through the issue of bonds can even be used for the repayment of previous debts (debt rollover). Logistic regressions confirmed that debt rollover increases the probability of substituting bank credit with the corporate bonds issue (Model 1).

Firms seeking to improve their liquidity (Models 2 and 3), also due to a higher debt maturity (Model 3), are more likely to issue bonds. Furthermore, larger firms are proven to be less likely to borrow from banks (Model 5) and to use private and public debt in a complementary manner (Model 2).

Due to the insignificance of the size variable in the bonds issue and bank loans substitutability models, it was impossible to verify the applicability of the flotation cost theory to companies listed on the WSE. On the other hand, marginal effects for the debt variable reflecting the size of debt financing (from the issuance of bonds and/or borrowing from banks) are insignificantly higher for substitutability (Model 1) and weak substitutability (Model 4) of corporate bonds and bank loans than for borrowing from banks. Taken together, all these findings show that there are no grounds for accepting the flotation cost theory for Polish listed companies, according to which only firms with high capital needs issue their bonds on the public market, owing to the effect of scale.

8 Directions of further studies

This paper opens a door to the new research stream on the impact of information and risk disclosure on capital structure, in particular on the choice between public debt (corporate bonds) and private debt (bank loan). It links a theoretical stream of influence of asymmetry in information on capital structure and determinants of information disclosure, including main finance sources, by restating well-known research design on the impact of leverage on information disclosure (e.g. used by Białek-Jaworska and Matusiewicz (2015)) by raising a question on reverse causality. This paper should be treated as just the beginning of a new theory development approach. The authors know that the set of hypotheses is rather complex, and naturally, the answer is not unanimous. The used approach is novel. It needs some clarification. A somewhat clearer approach to what is being tested, what is the expected outcome under such scenario and why has been presented in the book by Białek-Jaworska (2018). However, there is still room for new research development in transition economies and an opportunity to contribute to the knowledge via a wider discussion of this novel concept in future research.

Further studies, besides extension of the research sample, may be directed towards identification of diverse determinants behind firms' choices of debt financing sources, depending on the bond issue nature (private versus public). Yet, to carry out a study like this, it is necessary to collect additional information about corporate bond buyers. This would make way for the identification of two groups: firms whose bonds are acquired by the bank issuing and guaranteeing the bonds; and firms offering their corporate bonds to investors from non-banking sectors.

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