Bank-firm relationships in Poland[1]

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Summary

The purpose of the study was to identify factors which influence bank-firm relationships in Poland, herein identified with relationship banking.

The results of empirical analysis have demonstrated that Polish firms readily establish single-bank relationships. The results of the econometric model, on panel data set, enabled verification of hypotheses concerning the determinants of relationship banking in Poland from the perspective of characteristics of firms, their crediting banks and macroeconomic environment. On the part of firms, the factors whose influence has been identified include: size, form of ownership and credit risk. On the part of the financial sector, the verification covered the influence of competition in the banking sector, competition on the part of the capital market and development of the banking sector. The study also concerned the impact of the business cycle on relationship banking in Poland.

The study utilised panel data from different sources: reports (NBP) information of large exposures in years 1997–2010, and other aggregated data (NBP, WSE, CSO).

Keywords: number of bank relationships, relationship banking.

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[1] This article includes personal views of the authors and does not present the position of the NBP. The authors are responsible for any and all errors.

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Table of contents

Introduction

The financial crisis in 2007–2008 led to reflections on how contemporary banking operates and on the usefulness of its regulatory system and supervision authorities. The reasons provided for the crisis include structural changes which had taken place in the banking sector over the last decades. Banks were becoming, to a larger and larger extent, universal banks and even financial conglomerates, operating in all segments of financial markets. The asset structure of banks was changing, with the share of off-balance-sheet assets growing. Banks focused on improving profitability and efficiency by using increasingly complex financial instruments; non-interest income was at par with interest income and at the same time, the base of deposits decreased (Schildbach 2011; Wallace, Herrick 2009). The crisis put these trends into question and reversed them, drawing the attention of both bank managers and regulators towards sustainable banking, based on stable customer relationships. Thus, it appears that currently, banks want to develop relationship banking, whose projected renaissance provides reasons to take up the subject and examine characteristics of bank-firm relationships.[3]

The results of empirical research concerning financial crises in Asian and Latin American countries as well as those concerning the latest financial crisis indicate that relationship financing may facilitate better access to funding even when a firm is experiencing financial issues (Hoshi et al. 1990; Giovanni et al. 2001; Abildgren 2011). One may assume that the stability of the Polish banking sector during the crisis (in 2008–2009, banks in Poland recorded relatively high financial results; bankruptcy of banks was not observed)[4] was to a certain extent affected by the predominant manner of cooperation between banks and enterprises in the form of relationship banking.

The main purpose of this article is to identify factors influencing bank-firm relationships in Poland in the context of relationship banking, both on the part of the firms, the financial sector and the macroeconomic environment. In the present study, relationship banking is identified with a bank-firm relationship which involves the

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[3] However, one should bear in mind that relationship banking is the strategy of smaller banks; as banks grow, they are more and more inclined towards arm's-length financing (Koch & MacDonald, 2010).

[4] See also PFSA (2011, p. 5).

firm having commitments towards one bank (so-called single relationship) during a specific time period. This is why the study puts particular emphasis on analysing the number of bank-firm relationships, understood as the number of banks providing credit facilities to a given enterprise.

Empirical analysis of relationship banking involved two stages. During the first stage, the examined population of firms was divided according to the number of relationships with banks. The second stage involved selecting, from among enterprises maintaining single-bank relationships, those which maintain relationship banking.[5] Information about the number of bank-firm relationships was obtained from bank reports submitted to the NBP. The study also utilised data received from other institutions (WSE, PFSA). The analysis covered only commercial banks and non-financial enterprises. Factors determining the number of relationships included both variables characterising enterprises (such as the size of the firm) as well as variables characteristic of the national financial sector (such as competition in the banking sector, credit risk and stock exchange development). The study also considered the effects of the macroeconomic environment on bank-firm relationships.

This study comprises four chapters. The first chapter contains an extensive presentation of the notion of relationship banking and references studies from international literature. The second chapter provides a descriptive analysis of bank-firm relationships in Poland (the first stage of the analysis). The third chapter presents econometric model used for empirical verifications of the stated hypotheses concerning the determinants of relationship banking in Poland (the second stage of the analysis). The fourth chapter describes the results of estimations obtained on the basis of the model. It also provides the results of hypotheses verification. The study ends with a conclusion, which presents the outcome and guidelines for further research.

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[5] For the purpose of this study, the definition of relationship financing has been provided in chapter 3.

1. Bank-firm relationships

Bank-firm relationships depend on numerous factors. The benefits and costs associated with them change depending on the business cycle and on the institutions which provide incentives to the interested parties to establish and support such relationships (Degryse et al. 2009). From the banks' perspective, relationship financing reduces negative selection associated with information asymmetry, which is particularly intensified during periods of financial crises or restrictive monetary policy. On the part of firms, relationship financing improves access to external financing.

The following chapter presents different definitions and determinants of relationship banking, based on literature on the subject.

1.1   The notion of relationship banking

The bank-borrower relationship, which involves primarily a bilateral loan agreement between two interested parties, remains the subject of research with regard to its nature, propagation and effects — for banks, enterprises as well as development of financial systems (Koch, Macdonald 2010 p. 21; Van Hoose 2010 p. 63; Cull 2011, p. 2; Elyasiani, Goldberg 2004, p. 315). The most crucial research problems undertaken in the field of relationship banking include determining the scale of its propagation, its characteristics and evolution under the influence of changes in markets for banking services, changes in the structure of financial systems (including technological changes) as well as its impact on terms and conditions of financing firms, goodwill of firms and banks, etc.

Cooperation between a bank and a firm, focused on provision of financing, is more durable than other customer-supplier relationships (e.g. in product markets or in the case of the majority of non-financial services). Bank-firm relationships are associated with the main tasks (functions) of banks: keeping the customer's account, implementation of loan agreements or other banking services (deposits, guarantees, derivatives). They involve exchange of benefits and information over time between the bank and the enterprise, leading to development of certain information resources, both on the bank's part (e.g. credit history, balance of funds on the account, etc.) and

on the firm's part (e.g. experience with consideration of credit applications). It is assumed that the bank and its customer (firm) are in a relational contract if they have an understanding which allows certain contract terms and conditions to be further specified over time. Over a longer time period, the customer relies on the bank, which provides it with financial services, whereas the bank depends on repayment of loans by its long-term borrowers and the borrowers purchasing loan-related services (Heffernan 2007, p. 9).

The theoretic background for relationship banking and relationship lending was established in the works of Stiglitz and Weiss (1983), which demonstrated the existence of this occurrence in the context of loan rationing and the risk of moral hazard. Benefits from this form of financing, involving diminished information asymmetry, have been shown in theoretical works of Hodgman (1963), Wood (1975), Diamond (1991) and Boot et al. (1993). It should be noted that early works dedicated to relationship banking point to the phenomenon of so-called deposit relationships. Hodgman (1961; 1963) demonstrated that firms with bank deposits enjoy better lending terms and conditions than firms without deposits. However, according to Wood, (1975) so-called lending relationships may develop independently and banks may extend loans at a lower price, hoping for higher income in the future. During long-term provision of financial services, the bank collects additional (soft) information about its customer. Information about the borrower is an important aspect of banks' lending decisions and its quality should improve proportionally to the duration and closeness of the cooperation (Diamond 1984; Petersen, Rajan 1994).

Some of the first comprehensive definitions of relationship banking were formulated in the works of Ongena & Smith (2000a), Boot (2000), Berger & Udell (2002). The authors of the abovementioned definitions attempted to synthesise terms used, among others, in works of Rajan (1992; 1996), Diamond (1984; 1991) or Petersen & Rajan (1994). In order to conduct flexible firm financing policy (especially during the difficult period of development), the bank should be in a close relationship with it. This relationship is referred to as relationship banking. In the abovementioned context, Ongena and Smith (2000a) define relationship banking as a relationship between a bank and a firm, which is something more than a simple,

anonymous financial transaction. Banks benefit from maintaining such relationships through better access to information about the firm, whereas the firm expects the bank to provide access to financing even when it is experiencing financial difficulties (such flexibility is not possible, for example, in an anonymous securities market). According to Ongena & Smith (2000a), relationship banking can be described with more detail using two dimensions. The first dimension is duration since the measure of relationship banking is the length of bank-firm cooperation (Wood 1975; Rajan 1997). The second dimension is the product scope of cooperation (Hodgman 1963). Boot (2000, p. 10) defines relationship banking as provision of financial services by a bank which: (1) invests in access to specific information about a customer, which is frequently publicly unavailable and (2) assesses the profitability of this investment while taking into account the duration of cooperation with the customer and banking products provided to it. Berger & Udell (2002) define relationship banking (relationship lending) as the bank being able to obtain information about the firm during cooperation. The information is then used to develop future business conditions of bilateral cooperation (loan availability, interest rates and collaterals). To sum up, relationship banking requires four conditions to be fulfilled: (1) banks being in contractual relationships with enterprises, (2) as a result of relationships enduring over time, banks (3) collecting information more extensive than that available from public (open) resources and (4) the collected information being confidential (unpublished) (Berger 1999 quoted after Dong, Li 2010).

There is a consensus that banks involved in relationship lending (among others Boot 2000; Cull at al. 2011) also offer other services which do not require such close relationships or are not binding for the parties in a long-term perspective. Such cooperation is referred to as transaction-oriented banking or arm's-length financing. In arm's-length financing, the parties develop agreements so as to choose the most beneficial terms and conditions. Arm's-length financing is mainly sought by large enterprises with high creditworthiness, in the case of which information concerning activity and results is public (Boot, Thakor 2000), but also by enterprises with lower creditworthiness which are for this reason "pushed away" from the bank and look for other means of financing (Memmel et al. 2007, p. 23).

However, it should be noted that the nature of cooperation between enterprises and a bank is, in practice, more complex and it is difficult to provide strict definitions of relationship banking and transaction-oriented banking. To simplify it, one can assume that if an enterprise uses services of only one bank at a given time (so-called single relationship), this cooperation takes the form of relationship banking (relationship financing). Otherwise, if there are more banks providing credit facilities, we are dealing with multiple relationships or transaction-oriented cooperation. However, it should be noted that multiple relationships may also have the nature of relationship banking. As a result, banks may reduce the monopoly margin and offer better financing terms to current customers (Petersen, Rajan 1994, 1995; Berger, Udell 1995; Harhoff, Koerting 1998a ; Bonfim et al. 2009; Degryse et al. 2009). This cooperation usually involves a so-called main bank.

Relationship banking is more frequently encountered in countries such as Japan and Germany, where there are strong capital relationships between banks and enterprises from the non-financial sector (Ongena, Smith 2000a). In Japan and Germany, in the previous century, close bank-firm relationships were considered to be one of the key success factors for these economies. However, in the 1990s, the popularity of relationship banking dropped due to enterprises having more opportunities of obtaining funds and increased number of players in the financial market (Haffernan 2007, p. 10).

1.2 Benefits and costs of relationship banking

Literature seeks answers to the questions about the benefits and costs of relationship banking, both for banks and enterprises, as well as about its effects on development of banking systems and the economy. The most important advantage of relationship banking is minimised agency dilemma on the principal-agent line (which occurs as a result of a contract between the lending bank and the firm) thanks to the bank obtaining additional information and reducing the costs resulting from the issue of negative selection (Haffernan 2007, p. 9). Theoretical models suggest that for firms, maintaining multiple relationships is expensive, primarily due to transactional costs

(Diamond 1984). However, empirical research provides no explicit answers, while costs and benefits depend on many factors.

Relationship financing leads to better two-way information flows, the parties getting to know their mutual expectations, deeper recognition of the customers' situation as the basis for trust and improved flexibility of action in the case of atypical financial requirements. Information obtained by the bank in the process of relationship financing allows it to better predict the behaviour and risk profile of the entrepreneur/borrower. Combined with larger resources of information about the economic situation at the bank's disposal, it makes the bank more inclined to continue to finance the enterprise's activity even when it is experiencing financial difficulties. The strength and significance of such a relationship should increase along with the bank's exposure (credit) towards a given enterprise as well as along with increased share of exposure to a given enterprise in the bank's total assets (Memmel et al. 2007, p. 2).

Benefits of information about customers, following from relationship financing, may be among the main factors of banks' profitability (Boot 2000). Information obtained thanks to relationship banking allows banks to provide long-term, renewable and flexible credit facilities to firms which are their customers, which decreases the probability of banks' bankruptcy due to conducting less risky (conservative) activity (Keeley 1990). The scale of benefits for the bank depends on the quality of information about the customer and diversified quality of this information determines the level of the bank's specialisation in establishing relational contracts (learning by lending). It was determined that having information about the behaviour of customers (e.g. credit card users) provides significant benefits to both individual banks (Agarwal et al. 2009, p. 21) and entire banking systems (Cull et al. 2011, p. 2). Profit from relationship banking depends on the competition in the banking sector (see e.g. Boot, Thakor 2000). Increased competition in the banking sector reduces profitability of relationship banking by diminishing stimuli to maintain close relationships (Ergungor, Thomson 2005); however, this depends on the degree of market concentration (Elsas 2005). Access to information about customers and its use may be the key to retain competitive

advantage, especially for smaller banks (Berger, Udell 2002; Boot, Marinc 2008, p. 6).[6]

Benefits from relationship banking for firms are also extensively discussed in literature and concern primarily reduction of the negative effects of information asymmetry (see e.g. Diamond 1991; Petersen & Rajan 1994). However, review of empirical literature indicates that relationship financing based on a close customer-bank relationship involves not only benefits, but also costs — both for the banks themselves and for the credited firms. On the one hand, establishing a long-term relationship based on information collected by both parties reduces transaction costs resulting from negative selection and agency dilemmas (see e.g. Diamond 1991; Boot 2000); moreover, a strong relationship with a bank may also improve the firm's image and reputation. On the other hand, close cooperation with the bank may be costly for the enterprise (borrower), which has been demonstrated, based on theoretical models, by Sharpe (1990) and Rajan (1992) and which has been confirmed in many other empirical works (e.g. Agarwal et al. 2009). A single-bank relationship may result in occurrence of monopoly rent in the form of so-called hold-up problem (Sharpe 1990; Rajan 1992; Von Thadden 1992; 1995), i.e. having information monopoly about the customer reduces competition in the market of bank loans, which causes an increase in loan prices in the future (*ex post*) (Boot 2000). A single-bank lending relationship may take the form of monopoly for the customer, with all of its consequences. The entrepreneur may reduce monopolistic pressure by comparing offers and actions of individual banks and establishing relationships with subsequent banks (Broecker 1990). When relationship financing increases the cost of financing for the bank's customers (by taking advantage of the bank's market strength, but also the necessity to service and monitor numerous contracts), it may become a barrier for development of small and medium enterprises.

The costs of relationship banking are also borne by banks themselves (the soft–budget constraint problem). In the case of relationship financing, banks prolong crediting of firms which are experiencing financial difficulties, hoping to retrieve the

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[6] As its assets increase, the bank becomes more inclined towards transaction-oriented banking (Koch, Macdonald 2010, p. 21; Cole et al. 2004).

previous loan, although being familiar with the firm's situation, they should not be doing it. However, if the bank chose not to prolong crediting, it would certainly lose the original loan (Boot 2000). Relationship financing can also give rise to opportunistic behaviour in entrepreneurs, who take advantage of their creditworthiness and multi-annual cooperation with the bank in order to obtain further financing (Haffernan 2007, p. 9).

Literature dedicated to relationship financing also mentions studies concerning the optimum number of banks financing a firm (see e.g. Harhoff & Körting 1998a; 1998b; Detragiache et al. 2000; Cartletti 2004; Carletti et al. 2007; Bonfim et al. 2009; Cartletti 2004; Carletti et al. 2007). Using services of a single bank reduces transaction (monitoring) costs, and hence the loan costs for the firm; however, it may not be the optimum strategy for the firm if the bank providing the credit facility experiences liquidity issues. As the likelihood of the bank losing liquidity increases, the optimum number of bank-firm relationships grows (Detragiache et al. 2000).

A difficult situation in the banking sector works to the advantage of relationship banking, which has been confirmed by studies dedicated to crises in Asia (Nam 2004). In conditions of a crisis (caused by either economic or natural factors, such as flooding), banks maintaining close relationships with entrepreneurs may subsidise their customers by offering better crediting conditions, in particular for small, loyal entrepreneurs (Berg, Schrader 2010). Empirical results have demonstrated that strong, durable relationships with banks had positive influence on development of enterprises and their fate during economic crises (Van Overfelt et al. 2005; Fok et al. 2004). Hoshi et al. (1990) demonstrated that strong relationships with banks made it possible to reduce the costs of the crisis in Japan. The results of analyses conducted by Giovanni et al. (2001) also showed that during the financial crisis in Korea in 1997–1998, relationship financing allowed firms to maintain the right level of liquidity and saved them from bankruptcy. A study on relationship financing, covering the period of the last financial crisis, demonstrated that the impact of this occurrence on the likelihood of bankruptcy of firms in Denmark depends on the standing of the bank providing the facility (Abildgren et al. 2011).

1.3 Sources of information about relationship banking

In scientific research practice, information about bank-firm relationships is obtained from multiple sources. Researchers use data from lending registers of the banks themselves or systems for exchanging information about financial liabilities (Ongena, Smith 2000b), survey data obtained from entrepreneurs, supplemented with data about enterprises and banks (Berger, Udell 1995; Nam 2004; Tymoczko, Pawłowska 2007). Another possible source of knowledge about bank relationships may be information about material events (e.g. conclusion of a loan agreement), submitted by stock-listed issuers of securities (Chang et al. 2010; Berg, Schrader 2009) as well as results of statistical research (individual and aggregated — Ogura, Yamori 2008). Many research problems are analysed through integration of individual data from different databases, including survey data (Castelli et al. 2010).

Registers of major exposures (so-called central loan registers) maintained by supervisory authorities provide a valuable source of information about bank-firm relationships (see e.g. Schmieder 2006; Memmel et al. 2007; Jimenez, Saurina 2009; Albertazzi, Marchetti 2010; Gersl, Jakubik 2010; Antao et al. 2011). The reason for existence of registers of major exposures is supervisory provisions restricting concentration of the bank's receivables in a single entity. These provisions have been set forth in order to avoid a situation in which a bank would be exposed to a risk critical to its existence as a result of insolvency of the main creditor. The first regulations of this sort were established in Germany in the 1930s and are currently common in international and national banking laws (Schmieder 2006).[7]

The Polish law restricts the amount of receivables with respect to a single customer to 25% of the bank's capital. Moreover, the sum of all major exposures in the bank's assets (i.e. exposures exceeding 10% of the bank's capital) may not exceed the limit of eight times the amount of its capital. Boundary amounts of registered exposures differ from country to country, although theoretically, the same reference level (EUR 500 thousand) should apply in all EU Member States. The aforesaid level follows from the amount of minimum required level of capital necessary to establish a bank, which is EUR 5 million. However, in the majority of

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[7] The first registers of so-called major loans were established after World War II in France (1946), Belgium (1954), Spain (1962) and Germany (1962), see also Schmieder (2006, p. 4).

cases, threshold amounts are set below this value, with the exception of Germany, where the "major exposure" threshold is set at a level 3 times higher than the required minimum, although there are plans to lower it to EUR 1 million (approx. PLN 4 million) from 2013. In Poland, the threshold amount is PLN 500 thousand (currently, an equivalent of EUR 120 thousand).[8] In Germany, the reporting cap is currently EUR 1.5 million (PLN 6.3 million); in Spain, the "cut-off" amount is EUR 300 thousand (PLN 1.2 million), in Italy — EUR 30 thousand (approx. PLN 125 thousand), while in France — EUR 25 thousand (approx. PLN 100 thousand).[9] Several countries monitor transactions up to the amount of several dozen euro. In the Czech Republic, data is collected about liabilities exceeding EUR 70 and in Portugal — those exceeding EUR 50.

Data included in supervisory registers may, apart from being used for prudence purposes (i.e. to determine the structure of receivables of individual banks and compliance with supervisory provisions), provide information about the behaviour (relationships) of transaction entities, i.e. banks and their major customers.

1.4 Determinants of the number of relationships with banks

The results of empirical research to date have demonstrated numerous factors influencing the enterprise's and/or the bank's decisions to select the model of cooperation based on a single bank-firm relationship or multiple banking relationships.

In current research on the number of bank-firm relationships, determinants which are considered important include features of enterprises as well as characteristics of banks which provide credit facilities, features of the financial sector and of entire economies. Further on in this chapter, you can find detailed descriptions of the results of empirical research obtained from models in which the variable describing relationship banking is the explained variable (endogenous variable). Explanatory variables in these models are variables which determine

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[8] Pursuant to Resolution No 23/2003 of the Management Board of the NBP, based on Article 23 paragraph 4 of the Act of 29 August 1997 on the National Bank of Poland.
[9] For non-resident customers, this threshold was lowered to EUR 6 thousand in 2011.

competition in the banking sector, the size of firms, R&D expenditure, institutional features and macroeconomic factors.

Competition

Competition in the banking sector (e.g. measured with concentration of lenders) is a crucial determinant of the number of bank-firm relationships. However, the influence of competitive conditions in the banking sector on the number of lending relationships and distribution of relationship banking is ambiguous. On the one hand, growing competition reduces information about the customer available in the market due to the bank's diminishing share in the market. On the other hand, as competition grows as a result of new banks entering the sector, banks invest in establishing relationships with customers in a given market segment in order to generate profit (Boot 2000).

Empirical research on the influence of competition in the banking sector on functioning of relationship banking has been described extensively in literature dedicated to the microeconomy of the banking enterprise (see e.g. Berger, Udell 1995; Petersen, Rajan 1995; Boot, Thakor 2000; Detriagache et al. 2000; Berger & Udell 2002; Berger et al. 2001, Machauer, Weber 2000; Degryse et al. 2009; Presbitero, Zazzaro 2010). On the one hand, it was demonstrated that there is a positive relation between competition in the banking sector and relationship financing (Petersen, Rajan 1995; Boot, Thakor 2000); on the other hand, a negative relation between the two has also been found (Memmel 2007). However, the latest works suggest a U-shaped relation between competition (concentration in the banking sector) and the number of bank relationships or concentration of the enterprise's debt (Presbitero, Zazzaro 2010).

When studying the influence of growing competition in the banking sector, Boot & Thakor (2000) established that this growth of competition results in increased interest of banks in providing credit facilities to enterprises which require relationship (individual) approach and supports establishment of bank-firm relationships, creating the opportunity to obtain benefits as a result of having unique data about the enterprise and its activity. Elsas (2005) and Degryse et al. (2009) have demonstrated a non-monotonic dependency of the number of bank-firm relationships on the status of competition in the banking market. Single-bank

relationships become more likely as competition increases; nevertheless, in markets with a high degree of concentration, lower competition works to the advantage of relationship banking.

Due to the structure of the financial sector in different countries, in research on relationship banking, it is justified not only to analyse competition in the banking sector itself, but also to discuss more extensively the influence of competition on the part of other institutions in the financial market (e.g. capital market). However, even in this case, both forms of banking/financing coexist in balance sheets of enterprises (Rajan, Zingales 1998).

Size of firms

From the point of view of firms, an important determinant of the number of bank-firm relationships is the size of the borrower (Ongena, Smith 2000b; Neuberger, Rathke 2006; Memmel et al. 2007). Memmel et al. (2007) have demonstrated that the number of enterprises using the services of a single bank quickly diminishes as the size of the enterprise in the sample increases. A study conducted by Ongena & Smith (2000b) on a panel of several European countries has demonstrated a U-shaped dependency of the average number of relationships on the enterprise size. Very small and very large enterprises are characterised by a high average number of single-bank relationships, although in the case of small entities, firms using credit facilities of a single bank are more frequent.

Innovations

Relationship financing recognises the value of durable cooperation with customers for better two-way information flows and getting to know mutual expectations, also in the case of atypical financial requirements, which are associated, among others, with innovative activity (Ogawa et al. 2005, p. 7; Neuberger, Rathke 2006, p. 29). Investments in research and development (R&D), but also financing new technologies, are associated with the strategy of relationship financing (see e.g. Bhattacharya, Chiessa 1995; Rheinbaben, Ruckes 2004; Brighi, Torluccio 2009).

The influence of innovative activity on relationship financing is ambiguous. On the one hand, in the case of innovative activity, if a firm is certain of its project's success, it negotiates contractual conditions with a single bank, whereas a firm in a

weaker position will seek financing of multiple borrowers (Yosha 1995). Positive influence of innovativeness on multiple-borrower financing may be caused by banks' endeavour to distribute the risk connected with financing innovative projects (Cosci, Melliciani 2002, p. 8) or firms' endeavour to minimise the risk involving the fact that due to liquidity issues of the bank providing the credit facility, the investment project will have to be prematurely terminated (Detriagache et al. 2000). On the other hand, positive influence of innovative activity on relationship financing has been confirmed by Memmel et al. (2007) on a group of small, medium and large enterprises in Germany. The empirical analysis has demonstrated that relationship banking has a positive correlation with the intensity of R&D expenditure in individual industries.

Institutional factors

Studies dedicated to institutional factors influencing bank-firm relationships concerned the efficiency of the judicial system, protection of lenders' rights, observance of the law and legal tradition and were discussed, among others, in the works of: Ongena, Smith (2000b) and Qian, Strahan (2007). Ongena & Smith (2000b) have shown that higher efficiency of the judicial system and better protection of lenders' rights support maintenance of a smaller number of bank relationships. When analysing firms in France and Germany, Qian & Strahan (2007) concluded that firms with a lower level of legal efficiency and shareholder protection have more relationships with banks.

Corporate governance

Nam (2004), on the basis of a survey conducted among large banks in Korea (after the financial crisis), demonstrated that development of relationship banking depends on the form of ownership of banks and composition of supervisory boards. Theoretically, banks can influence enterprise management if their representatives are members of supervisory boards of enterprises, which occurs in particular in bank-oriented financial systems, e.g. in Germany and Japan (Ongena, Smith 2000a). This mechanism results from the bank's share in the firm's shareholding structure, which can result in access to information about the firm within the scope stipulated by the law of control over firm management. In such a situation, banks may influence firms

not only when their financial standing is good, but especially when they are in a critical position. It is assumed that a personal relationship between the bank and the firm (via a supervisory board member) will result in the bank behaving loyally towards the firm and extending a loan to it in a situation of economic difficulties (deterioration or loss of creditworthiness by the firm). However, when shareholders entrust the function of a member of the supervisory board (board of directors) to a bank representative who does not hold shares in the firm, this constitutes corruption, in particular if a bank were to finance an enterprise without creditworthiness.

Control through participation in a supervisory board may be beneficial for firms in a difficult financial situation, but it can give rise to the problem of monopoly of power over the firm (Ongena, Smith 2000a). In the case of arm's length financing, when payment difficulties occur for the debtor, the bank is not interested in protecting the enterprise from bankruptcy.

Macroeconomic factors

The number of relationships may change over time in the business cycle; at different stages of the business cycle, firms may change the manner of external financing from banks to that based on the capital market (Kashyap et al. 1993). The few studies available in this field (Dietsch 2003; Hommel, Schneider 2003) provide no unequivocal results.

1.5 Implications of relationships with banks

Apart from works which attempt to explain factors advantageous to relationship banking, there is a number of studies dedicated to its influence on different factors concerning financing of firms. The main questions in this type of studies, in which the variable characterising relationship banking occurs in the model as the explanatory variable, concern the cost of the loan, availability of the loan, profitability of banks, as well as influence on profitability of firms and other sources of financing.

Influence of relationship banking on the cost of the loan

Boot & Thakor (2000) concluded that in the sample of small American enterprises examined by them, loan interest rate drops as the entity's cooperation with the bank

gets longer (there may also be a different dependency between the length of bank-enterprise cooperation and the interest rate, taking into account the degree of competition in the banking sector). However, Research by Sharpe (1990), Greenbaum et al. (1989) as well as Petersen & Rajan (1995) shows that the loan interest rate may increase along with duration of cooperation between the bank and the entity — in this manner, banks compensate for earlier, more risky financing of unknown firms. The cost of the loan in a market with a diverse degree of competition depends on the firm's age — banks behave differently with respect to mature and newly established firms. Banks' interest in financing firms which have not been previously verified results from the necessity to win customers and expand the credit portfolio. At an early stage of firm development, banks provide relatively cheap capital; the older the firm gets, the more expensive the capital becomes. Banks in a market with lower competition levels count on future advantages from crediting a given firm. This is why they decide to provide relatively cheaper capital at the beginning of its operation (Tymoczko, Pawłowska 2007).

Influence of relationship banking on profitability of firms

Some empirical works also analyse the influence of the number of relationships with banks on the firm's financial results. Karceski et al. (2000) and Degryse et al. (2009), on the basis of empirical research, demonstrated that apart from the firm's size, an important factor affecting relationships with banks is profitability (especially of small firms).

Castelli et al. (2006; 2010) proved that ROA and ROE of Italian enterprises were dropping in 1998–2000 as the number of banks providing credit facilities increased (multiple-bank), in particular among small firms. The results of these works support the thesis that a single-bank relationship reduces information asymmetry and agency costs and allows to neutralise the effect associated with the so-called monopoly rent (hold-up problem). On the other hand, Weinstein & Yafeh (1998) have demonstrated a negative dependency between profitability of enterprises and relationship financing on the basis of research conducted on Japanese firms in 1977–1986.

Influence of relationship banking on other sources of financing

Kutsuna et al. (2003) indicate that relationship financing also affects access to other sources of financing and improves access to financing in the capital market. By efficiently using bank financing and establishing their reputation, enterprises enter capital markets in order to diversify their financing (Sharpe 1990). A bank providing credit facilities to a firm may have positive results for the firm's value in the capital market. Continued financing (i.e. extending new loans to the firm) is a signal for the market that the bank continuously monitors the firm's situation and estimates its chances of development as good.

Availability of a bank loan also affects the availability of a trade credit (Petersen, Rajan 1994; Marzec, Pawłowska 2011). Biais & Gollier (1997) have demonstrated that for the bank, the use of trade credit is a signal of having information about its customers and influences access to bank loans. They determined that using a trade credit and a bank loan is complementary since it signals the borrower's quality to the bank and makes it inclined to extend a loan. On the other hand Nielsen (2002) and Marzec & Pawłowska (2011), among others, have demonstrated the use of a trade loan as a substitute for a bank loan.

Relationship banking has influence on the functioning of the balance-sheet and the bank lending channel (Kashyap et al. 1993; Bernanke, Blinder 1988). In the model presented in the work of Kashyap et al. (1993), monetary policy impacts the structure of financing of firms through the bank lending channel while taking into account bank-firm relationships. Empirical research concerning the influence of relationship banking on the bank lending channel has been conducted, among others, by Valderrama (2001). Using panel data concerning Austrian firms in 1994-1999, she demonstrated that firms which have close relationships with a bank (house bank) weaken the bank lending channel and limit the liquidity constraint in firms due to avoiding information asymmetry.

2 The number of bank-firm relationships in Poland — a descriptive analysis

The following chapter presents the results of a descriptive analysis of the number of bank-firm relationships in 1997–2010. The basic source of information about bank-firm relationships in Poland was provided by the data submitted to banking supervision bodies on NBP forms (register of major exposures). They contain a list of customers in whose case the exposure of a given bank is major, i.e. exceeds PLN 500 thousand in the case of commercial banks. The number of bank-firm relationships was defined as the number of banks in which it was specified on the NBP form of large exposure[10].

2.1 Bank-firm relationships in Poland — basic information

The analysis was carried out on a sample of 32,241 separate non-financial enterprises and covered the years 1997–2010 (see appendix 1, table 1). During the analysed period, the average number of relationships with banks in a given population remained at a similar level of approx. 1.6, which was partially due to domination of enterprises maintaining single-bank relationships — in individual years, they constituted more than 60% of all analysed enterprises (see appendix 1, table 2).

Starting from 2008, one could observe an increasing share of such enterprises, which translated to a slight drop in the average number of relationships in 2008–2010. Low popularity of the strategy which involves financing from multiple banks is confirmed by the fact that in the examined sample, even those enterprises which use services of more than one bank do not maintain a large number of relationships. During the analysed period, 20–25% of examined enterprises maintained relationships with two banks, whereas relationships with three banks were maintained by far less than 10% of enterprises. Contacts with more

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[10] The bank's exposure (loan) is considered "major" for supervisory purposes if it exceeds the value of 10% of the minimum admissible value of the bank's own funds. In European and Polish provisions of the banking law, this amount is EUR 5 million, i.e. the threshold of 10% is EUR 500 thousand, i.e. approx. PLN 2 million.

than 5 banks were rare in the examined sample — they occurred in approx. 1% of enterprises. There was more volatility in the maximum number of banks whose services were used by a given enterprise — depending on the period, it varied between 16 and 32. These, however, were individual cases.

Enterprises maintaining single-bank relationships were the dominant portion of the analysed sample (more than 60%); however, their share in total debt of examined firms was considerably smaller and remained between 29.4% and 40.4%. This may suggest that the group of entities maintaining relationships with multiple banks comprises the largest entities with the biggest lending requirements.[11] This is also suggested by data on the most active entities, which have relationships with more than 5 banks. In 1997–2010, they constituted approx. 1% of enterprises; however, their share in debt was approx. 20% (see appendix 1, table 2).

3   Panel study

This chapter, on the basis of the literature review presented in chapter one, formulates a number of hypotheses concerning relationship banking, which are subject to empirical verification. It should be noted that the literature review presented in chapter one was very broad, whereas the empirical part of this study, concerning Polish market, uses only those issues which are permitted by access to data. Nevertheless, the study conducted in the second stage allowed for a relatively broad analysis of the occurrence concerning the manner of financing firms and its determinants in Poland. The study applied the approach which involves combining data from different available sources, commonly applied in literature on the subject (e.g. Ogawa et al. 2005, Memmel et al. 2007). This is one of the first comprehensive studies of relationship financing in Poland. Previous empirical studies concerning the Polish banking sector covered only survey data for one period — 2005 (Tymoczko, Pawłowska 2007).

The results of descriptive analysis of the number of bank relationships, presented in the previous chapter, have demonstrated that the dominating strategy of Polish enterprises is maintaining single-bank relationships. This is why the study

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[11] Due to the debt threshold of PLN 2 million, the research sample does not include small enterprises.

assumed that enterprises which maintain single-bank relationships apply relationship banking.[12] However, there may be situations where an enterprise has exposure in a single bank, but this bank changes every year, which does not testify to relationship lending. Nevertheless, according to the data presented in appendix 1 (table 2), single-bank relationships are relatively durable — in the majority of studied periods, the share of enterprises which maintained single-bank relationships with one and the same bank both in a given year and 3 years prior varied between 63.9% and 82.6%.

Taking into account the above assumptions, analysis of literature and database structure, the following simplified definition of relationship banking was adopted for the purpose of this study: **an firm applies relationship financing if it has liabilities towards only one bank (balance sheet and off-balance sheet liabilities, including loans) over a period of three years.** A similar definition, taking into account both the number of banks providing credit facilities and the duration of cooperation was applied, among others, in the works of Elsas (2005) and Memmel et al. (2007).

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[12] See definitions of relationship banking presented in chapter 1.

3.1 Research method and data sources

The characteristics of the modelled occurrence as well as the adopted research assumptions determined the choice of tools used in empirical verification of formulated hypotheses. The analysed occurrence involves bank-firm relationships, which take the form of relationship banking in specific conditions. According to the adopted definition, this form depends on the number of banks with which the firm maintains lending relationships in subsequent periods. In this situation, given the same number of relationships with banks in a given year, a given firm may be qualified in a group of enterprises which apply relationship banking or not, depending on its behaviour in periods preceding the analysed period.

In the case of the adopted definition of relationship banking, only two options are possible: presence of relationship banking (when the firm remains in a lending relationship with only one and the same bank over three subsequent periods) or absence of relationship banking (in all other cases). According to the adopted assumptions, relationship banking is binary; there are no intermediate states and there is no scale to assess the strength of the relationship. For this reason, further analyses employ the logit model, in which the dependent variable may assume one of the following values: one (associated with success, i.e. in this case a situation where relationship banking is present) or zero (failure, lack of relationship banking in contacts between a given firm and banks). Therefore, the results of this model may be interpreted in the category of probabilities — a positive coefficient for a given variable means that it increases the likelihood of success. Such an approach is commonly applied in literature — the majority of authors studying bank-firm relationships apply different versions of models with discrete dependent variable, including in particular logit models (see table 1).

Table 1. Tools used to study bank-firm relationships

Authors	*Type of data*	*Method*
Detragiache et al. (2000)	cross-sectional	Two-step estimation: probit (choice between single-bank relationships and multiple-bank relationships) and LSM (the optimum number of relationships for firms maintaining contacts with multiple banks; in simplification, the authors treat the number of relationships as a continuous variable, which enables them to apply LSM).
Ongena, Smith (2000)	cross-sectional	Tobit model to assess the influence of features of firms, industries and characteristics of individual countries on the number of relationships for comparative data between countries, LSM to assess the influence of different factors at a national level.
Machauer, Weber (2000)	Panel	Poisson model with random effects to explain the number of relationships.
Cosci, Meliciani (2002)	cross-sectional	Negative binomial model to explain the number of bank-firm relationships.
Yu, Hsieh (2003)	cross-sectional	Logit model to assess the influence of firms' features on the choice between maintaining a single-bank relationship and multiple-bank relationships.
Guiso, Minetti (2004)	cross-sectional	Heckman two-step procedure. In the first step, the probit model for assessment of the probability that the firm chooses financing from multiple banks; followed by assessment of diversity of the number of relationships for firms maintaining relationships with more than one bank.
Berger et al. (2005)	cross-sectional	Heckman two-step procedure — in the first step, assessment of probability of a firm maintaining multiple-bank relationships and subsequently analysis of the number of relationships. Moreover, the Poisson model to explain the number of maintained relationships with banks and probit models to assess the probability that the firm will diversify the form of ownership of banks financing it.
Ogawa et al. (2005)	cross-sectional	Logit model to assess the decision about maintaining a single-bank relationship, multinominal logit model for detailed analysis of the decision to maintain contacts with multiple banks, tobit model to analyse concentration of loans.
Memmel et al. (2007)	Panel	Logit model with random effects to specify the factors determining maintenance of a single-bank relationship.

Source: own study.

The majority of studies employ models based on cross-section data (taking into account a single analysis period); this study uses longitudinal (panel) data. The advantage of panel data is that the analysis takes into account both diversity between firms and changes taking place over time. The temporal dimension may be of particular significance in developing economies (such as Poland), where very fast and deep economic transformations are frequent and may be reflected in bank-firm

relationships. Adequately long time series also allow for inclusion of different phases of the economic cycle. Using the panel model in the analyses necessitates specification of the type of individual effects used in it and choice between fixed and random effects.[13]

In the case of this study, the specific nature of the sample had major impact on the choice of the effects. Its dominant portion comprises enterprises which continuously maintain relationship banking — for such entities, the explained variable will be constant over time (its value will be 1 in every period). An attempt to estimate the model with fixed effects would cause their removal from the study (as a result of the *within* transformation[14]), which would contradict the purposes of the study (in an attempt to assess the factors determining relationship banking, we would remove firms most willing to apply such banking from the sample). Due to differences in the size of the samples and different assumptions regarding the type of individual effect, it is impossible to apply the popular Hausman test[15] and formally decide of the choice between fixed and random effects.

Eventually, to specify the factors determining relationship banking, a panel logit model with random effects was used (a similar approach was applied in a work by Memmel et al. 2007).[16]

Panel A covers the years 1999–2010[17] and in making use of it, an attempt was made to verify hypotheses concerning determinants of relationship financing on the part of the banking sector and macroeconomic environment. Additionally, tests covered hypotheses concerning the sector of firms for which variables were available, among others, in the lending register. Panel construction also employed annual data concerning the financial sector, obtained from the NBP (BIS), PFSA, CSO and WSE databases.

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[13]See also: Ciecieląg, Tomaszewski (2003, pp. 33–35).

[14] The *within* transformation involves the mean value over time of a given variable being subtracted from that variable (see e.g. Wooldridge (2001, pp. 267-268). For other fixed variables, the mean value is equal to the variable itself and the difference amounts to zero.

[15] The Hausman test compares estimators obtained from models with fixed and random effects (see e.g. Baltagi 2001, pp. 65-69). If models have been estimated based on samples of different sizes, the estimators cannot be compared.

[16] The detailed form of the model has been presented further on in this study.

[17] The data panel had to be shortened with respect to the set used for descriptive analysis, due to the definition of relationship banking.

3.2 Main Hypothesis

The data in panel A was used to test the hypotheses concerning the sector of firms, information about which was included in the B0300 database (the facility size and credit risk), as well as structures of ownership and innovative activity, obtained from other sources. Variables in panel A, concerning the financial sector and macroeconomic environment, served to verify subsequent hypotheses.

With respect to the firms sector, the following hypotheses were tested:

- *Hypothesis 1: firms with larger lending requirements are more inclined towards arm's-length financing (in multiple banks). This fact may be connected with conducting larger investment activity, which requires multiple financial partners (the anticipated sign for this variable is negative).*

- *Hypothesis 2: growth of credit risk supports maintaining a single-bank relationship. Typically, firms with the highest quality of credit portfolios borrow from multiple creditors (the anticipated sign for this variable is positive).*

- *Hypothesis 3: the more innovative the firm, the greater the importance of relationship banking (the anticipated sign for this variable is positive). It appears that conducting innovative activity requires a relationship approach, which allows for financing of atypical requirements, such as R&D expenditure.*

- *Hypothesis 4: foreign property supports maintaining a single-bank relationship (the anticipated sign for this variable is positive). This fact may be connected with the daughter company using the same bank as the parent company.*

The choice of the manner of financing depends on factors characterising the situation in the financial sector and the macroeconomic environment. The financial system in Poland is based primarily on banks, whose share in assets of the entire financial sector in 2010 amounted to 69.6%.[18] The Polish banking sector is clearly dominated by commercial banks,[19] although the role of other financial institutions is systematically growing. Among the features of the banking sector, the factors which influence relationship banking include the financial standing of banks and concentration (competition). Empirical results concerning the influence of competition (measured using concentration measures) on relationship banking are ambiguous. On the one hand, a negative dependency has been demonstrated (see e.g.

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[18] See also NBP (2010; 2011).
[19] Share of cooperative banks in the banking sector is approx. 6%, see also NBP (2011).

Memmel et al. 2007); on the other hand — a positive one (see e.g. Petersen, Rajan 1995; Boot, Thakor 2000). Some works also indicate that average level of competition is the most advantageous for relationship financing (Dinc 2000; Yafeh, Yosha 2001).[20]

With respect to factors on the part of the financial system, the following hypotheses have been formulated:

- **Hypothesis 5:** *increasing competition/decreasing concentration in the banking sector supported maintaining a single-bank relationship (the anticipated sign for this variable is negative). The Polish banking sector is moderately concentrated, which demonstrates moderate competition level. Hence, in this case, growth of competition supports relationship financing and reduces the so-called hold-up problem.*

The Warsaw Stock Exchange was developing dynamically during the analysed period.[21] Boot & Thakor (2000) demonstrated that a more competitive capital market reduces relationship banking, hence the following hypothesis concerning the influence of competition in the capital market has been formulated:[22]

- **Hypothesis 6:** *growth of competition in the capital market reduces interest in relationship banking (the anticipated sign for this variable is negative).*

Research on crises points to increased interest in relationship financing during periods of economic slowdown; however, this is due to the financial condition of banks. It should be noted that during the analysed period, the usage of banking services, measured with the ratio of sector assets to GDP, was systematically increasing — in 1997–2010, banks were developing faster as compared to economic growth. This is why the following hypotheses have been formulated with respect to the Polish economy:

Hypothesis 7: *increasing role of the banking sector in the economy supports establishment of a single-bank relationship (the anticipated sign for this variable is positive).*

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[20] Markets for which HHI is below 0.1 are considered unconcentrated; when the value of the index exceeds 0.18, the market is considered concentrated (see also ECB 2005). It is assumed that the market is moderately concentrated when HHI ranges between 0.1 and 0.18.

[21] See also NBP (2010; 2011).

[22] Providing credit facilities to a firm by a bank improves its credibility in the capital market, which has positive impact on its goodwill. This also applies to guaranteed issue of its shares, see also Petersen, Rajan (1995).

- **Hypothesis 8**: *economic slowdown supports establishment of relationship banking (the anticipated sign for the pkb variable is negative — the probability that a firm has a loan with a single bank increases as GDP decreases).*

On the basis of the above hypotheses, explanatory variables were chosen in the model — they have been presented in table 2 (the basic statistics concerning these data have been presented in appendix). The estimations also used binary variables for individual industries (as control variables).[23]

Table 2. Explanatory variables used in the study — panel A

Group of variables	Name of variable	Description of variable	Data source
Variables characterising the enterprise sector	lk	Logarithm of credit exposure of a given firm i during period t	NBP
	zagr	Binary variable characterising the type of property of a given firm i during period t, depending on the type of property: 1— foreign, 0 — other cases	NBP
	hightech	Binary variable of a given firm i during period t, determining whether the firm operated in the high-tech sector according to OECD: 1 — the firm operates in the high-tech sector, 0 — other cases	OECD[24]
Credit risk	nplp	The share of non-performing loans in total debt of firm i during period $t-1$	NBP
Concentration/ competition in the banking sector	CR5, HHI	Indices of concentration in the banking market (market share of the five largest banks, Herfindahl-Hirschman concentration index)	PFSA and own calculations
	lb	Number of banks and branches of lending institutions operating in Poland	NBP, PFSA
	nim, roab	Indices designating the financial situation in the banking sector (nim — net interest margin, roab — return on assets for banks)	own calculations, PFSA
Competition in the financial/ capital market	lgpw	Number of firms listed on the stock exchange (main market) and NewConnect market	WSE
Economic development	PKB	GDP growth	Central Statistical Office
Development of the banking sector	aktb_pkb	Relationship of banking sector assets to GDP	NBP, PFSA

Source: own study.

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[23] Analasis examined the enterprise sector in general; hence, control variables have been grouped as: processing, services, transport, construction. In panel A, control variables were taken into account as division into individual sections.

[24] OECD (2003). The abovementioned classification also includes knowledge-intensive services.

The following econometric model has been developed to verify hypotheses 1–8:

$$\ln\left[\frac{p(RE_{it}=1)}{1-p(RE_{it}=1)}\right]=\alpha_o+\sum_{j=1}^{n}\beta_j(FIRM_{it})+\beta_{n+1}(R\_K_{it-1})+\beta_{n+2}(K\_B_t)+$$
$$+\beta_{n+3}(\Delta PKB_t)+v_i+\varepsilon_{it} \tag{1}$$

where:

RE_{it} — assumes two values: 1 or 0. Hence, the explained variable assumes value 1 — when an event constituting so-called success has occurred — when the enterprise has a so-called single-bank relationship (i.e. its total liabilities are towards a single bank over three years) with probability p_i, the explained variable assumes value 0 — when an event constituting so-called failure has occurred — when an opposite event has occurred with probability 1 - p_i.

The following explanatory variables have been defined in the model:

$FIRM_{it}$ — a matrix of variables characterising the sector of firms described in table 4,

R_K_{it-1} — credit risk, measured with share of non-performing debt in total debt for each firm i during the period $t-1$,[25]

K_B_t — competition in the banking sector during the period,[26]

PKB_t — GDP growth over period t,[27]

v_i — individual random effect, ε_{it} — pure random index.

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[25]See also Degryse et al. (2005, p. 20).
[26] An alternative estimation was also carried out for competition in the financial/capital market.
[27] An alternative estimation was also carried out, with share of assets of the banking sector to GDP instead of GDP growth.

4 Estimation results

This chapter presents empirical results obtained from econometric models on the basis of which hypotheses formulated in chapter 3 were verified. Detailed results of estimations have been presented in appendix 2. Further part of the chapter discusses the results obtained for panel A.

4.1 Panel Analysis

The results of five estimations, allowing for verification of hypotheses 1-8 on the basis of formula 1, have been presented in appendix 2, table 8. The hypotheses presented in chapter 3.2. were verified through assessment of materiality of coefficients accompanying individual variables (using student's t-test). Selection of variables for individual estimations was based on formula 1 and the results of correlations between individual explanatory variables (see appendix 2, table 5).

Negative coefficients for the variable specifying the loan amount (*lk*) indicate that as the debt grows, the inclination to maintain a single-bank relationship decreases. Results for five estimations (see table 8, estimations (1)-(5)) allowed for positive verification of **hypothesis 1**, concerning the influence of the size of credit exposure on the type of financing.

Positive sign for the variable characterising credit risk (*nplp*) may indicate that firms experiencing financial difficulties are inclined to establish relationships with a bank (see also table 8, estimations (1)-(5)). The obtained results are in line, among others, with the results of Bolton & Scharfstein (1996), who demonstrated that firms with the highest quality of credit portfolios borrow from multiple creditors. On the other hand, von Thadden (2004) has demonstrated the opposite dependency.

Conducted estimations in panel A also demonstrated the relationship between relationship financing and firms conducting innovative activity. The coefficient for the variable (*hightech*), characterising innovative industries, was negative (see also table 8 estimation (3)). It should be noted that for estimations on panel A (coefficient for variable *udz_wnip,* characterising innovative industries, was insignificant in all alternative specifications). The obtained analysis results on panel

B may confirm the fact of sharing the risk associated with financing innovative projects (Detriagache et al. 2000; Cosci, Melliciani 2002).

All estimations conducted on panel A demonstrated the relationship between financing from a single bank and foreign property (the coefficient for the variable characterising foreign property (*zagran*) had positive sign in all alternative specifications, see also table 8 estimations (1)-(5))). The above results allowed for positive verification of **hypotheses 3-4** concerning the firms sector.

Moreover, on the basis of coefficients for variables characterising competition in the banking sector, an attempt was made to verify **hypothesis 5** concerning the impact of the situation in the banking sector on relationship banking. The analysis results have shown that drop of concentration in the banking sector, which may be identified with growth of competition, supports establishment of relationship banking. It is worth noting that for each measures of concentration (*HHI, CR5*), this coefficient proved significant and negative (also for squares of these measures). The obtained results are in line with the studies of Petersen & Rajan (1995) and Boot & Thakor (2000), who established that the growth of competition in the banking sector results in increased interest of banks in providing credit facilities to enterprises which require relationship (individual) approach and supports establishment of bank-firm relationships, creating the opportunity to obtain benefits as a result of having unique data about the enterprise. Confirmation of this thesis is also supported by the value of the coefficient, obtained in additional estimations carried out as a part of control of results, with other variables also specifying the level of competition in the credit market (net interest margin (*nim*), return on assets of banks (*roab*), number of banks (*lb*)). The results demonstrated a negative coefficient for the variables *nim* and *roab* and a positive coefficient for the variable *lb*, specifying the number of banks and branches of lending institutions in Poland (see also table 9, estimations (1)-(5)), hence **hypothesis 5** has been verified positively.

The result which proved to be contrary to literature (see also Boot, Thakor 2000; Ongena 2000b) was the one concerning competition on the part of capital market and **hypothesis 6**, concerning the influence of competition in the capital market, was verified negatively (the sign of the estimated coefficient for the variable (*lgpw)* on relationship banking proved positive, see also table 8 estimation (5)). It

appears that the obtained result involves the specific nature of the Polish financial sector, which is developing dynamically; simultaneously, competition in the banking sector and in the capital market is growing. In particular, during the period of financial crisis (2008-2009), stock exchange in Poland was developing extremely dynamically, generating competition for banks.

The result of estimation concerning the influence of the role of banks in the economy on relationship financing (see table 8, estimation (4)) proved in line with the expectations, as confirmed by the positive sign of the estimated coefficient for the variable (*aktb_pkb*). The obtained result allowed for positive verification of **hypothesis 7** and demonstrated that growth of banks' role in the economy makes firms more inclined to establish single-bank relationships.

The sign which proved contrary to literature was the one for the variable describing the business cycle - GDP growth (*PKB*) (see also table 8, estimations 1, 3 and 5). The results regarding influence of the business cycle on relationship banking have demonstrated that the probability of a firm having a loan with a single bank increases as GDP increases, whereas in estimation 2, the coefficient accompanying the variable (*PKB*) proved insignificant. Positive sign for the variable determining GDP growth (see table 8, estimations 1, 3 and 5) means that the occurrence of GDP is procyclical — positive economic trends supported establishment of in-depth bank-firm relationships, while economic slowdown provided stimuli for financing in multiple banks.

4.2   Control over correctness/robustness of results

To confirm the correctness of obtained results, estimations were carried out on both panels, using alternative measures (see also appendix 2, tables 9-10).

Using panel A, in order to confirm the influence of competition on relationship banking, with the use of a number of measures specifying the level of competition in the banking sector (also for squares of these measures). **Hypothesis 8**, concerning the influence of business cycle on relationship banking, was verified negatively, which was demonstrated by positive coefficient for variable (*PKB*). In order to verify the correctness of this result, additional estimations were made, determining the influence of individual years of analysis on the situation of relationship banking.

The results have demonstrated a negative sign for the years 2001-2002 and a positive sign for 2003-2010 (see also appendix 2, table 10). The years 2001-2002 are the years of economic slowdown, which means that in these years, the probability that firms used relationship financing was lower than in years 2003-2010. The obtained result confirms negative verification of **hypothesis 8**.

5 Conclusions

Bank-firm relationships depend on many factors, both microeconomic and macroeconomic ones, which provide incentives to the interested parties to establish and support relationships. The results presented in this study are predominantly compliant with the results of this type of research for countries where the financial sector is based on banks (see e.g. Memmel et al. 2007; Bonfim et al. 2009).

The empirical results of the first stage of analysis presented in this article have demonstrated that Polish firms readily establish relationships with banks. The descriptive analysis has shown that in 1997-2010, more than 60% of examined enterprises maintained single-bank relationships.

Additionally, the results of the second stage of analysis using econometric model allowed us to determine that relationship financing depends on factors on the part of firms, banks providing credit facilities to them as well as on the macroeconomic environment. In general, smaller enterprises, which have smaller lending requirements, and which are less profitable and characterised by higher credit risk, are more inclined towards relationship financing. Moreover, relationship financing is influenced by increased competition in the financial sector and the business cycle. The above main hypothesis was verified on the basis of thirteen detailed hypotheses concerning determinants of relationship banking in Poland using panel A.

The results of estimations using panel A confirmed the hypotheses regarding the influence of the size of credit exposure and demonstrated that as the debt grows, the inclination to maintain a single-bank relationship decreases, which may be associated with larger investment activity. Positive sign for the variable characterising credit risk may indicate that firms with the highest quality of credit

portfolios borrow from multiple creditors. The fact of sharing risk with other banks was confirmed by the results concerning innovative activity (the coefficient for the variable characterising innovative industries is negative in all alternative specifications). All conducted estimations demonstrated the relationship between financing from a single bank and foreign property.

The results of analysis using panel A have also confirmed that the drop of concentration in the banking sector, which may be identified with growth of competition, supported the establishment of relationship banking. The result which proved to be contrary to literature (see also Boot, Thakor 2000; Ongena 2000b) was the one concerning competition on the part of capital market. Empirical analysis has demonstrated positive influence of competition in the capital market on relationship banking.

Moreover, the results have shown that growth of the role of banks in the economy caused firms to become more involved in relationship financing. Positive sign for the variable determining GDP growth (business cycle) means that positive economic trends supported establishment of in-depth bank-firm relationships, while economic slowdown provided stimuli for financing in multiple banks (arm's length financing).

However, it should be noted that the results of estimations are always determined by the definition of the explanatory variable; hence, the results of the above study should be treated as preliminary. The occurrence concerning relationship banking requires further in-depth studies, among others using a different definition. Future research on bank-firm relationships should concern the influence of the relationships on the financing costs, maintaining relationships when the borrower is in a difficult financial position and features of banks using the strategy of relationship financing.

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Appendix 1. Breakdown of relationships with banks

Table 1. The number of bank-firm relationships — basic information

Year	Number of enterprises in the sample	Number of relationships	
		Mean/Median	**Maximum**
1997	5,012	1.6	29
1998	6,254	1.6	32
1999	7,562	1.6	18
2000	8,832	1.7	20
2001	9,247	1.6	17
2002	9,277	1.6	19
2003	9,877	1.6	19
2004	9,625	1.6	18
2005	10,169	1.6	16
2006	11,421	1.6	17
2007	13,586	1.6	19
2008	15,603	1.5	22
2009	15,498	1.5	21
2010	16,356	1.5	21
1997–2010	32,241	1.6/1	32

The data include non-financial enterprises, towards which the exposure of banks providing credit facilities exceeds PLN 2 million.
Source: own study.

* The adopted threshold of PLN 2 million concerns total debt of the firm in all banks (indicated on NBP form B0300). Failure to take the threshold into account would cause overestimation of the number of firms deciding to maintain single-bank relationships since this group would include both firms for which this strategy is a matter of choice and those which must be specified on forms only in one bank, due to the structure of the form. For instance: a firm which has a loan with a bank in the amount of PLN 2.5 million could theoretically be specified on forms by 5 banks (by taking out loans of PLN 500 thousand in each bank) — being restricted to one institution is therefore the effect of its choice. On the other hand, a firm with a loan with a single bank, amounting e.g. to PLN 700 thousand, may be specified on form in only one bank (since the reporting threshold is PLN 500 thousand).

Table 2. Breakdown of the number of relationships with banks in 1997-2010 (in %)

Year	Relationships with 1 bank		Relationships with 2 banks		Relationships with 3 banks		Relationships with 4 banks		Relationships with 5 banks		Relationships with more than 5 banks	
	Share in the number of enterprises	Share in debt	Share in the number of enterprises	Share in debt	Share in the number of enterprises	Share in debt	Share in the number of enterprises	Share in debt	Share in the number of enterprises	Share in debt	Share in the number of enterprises	Share in debt
1997	66.1	39.9	22.1	17.4	7.1	11.1	2.5	6.1	1.1	5.3	1.2	20.3
1998	63.1	34.7	24.6	19.5	7.4	10.9	2.4	7.7	1.2	5.1	1.2	22.1
1999	62.1	33.4	25.5	19.8	7.2	11.5	2.6	7.9	1.1	4.5	1.5	22.8
2000	60.4	29.4	26.5	22.4	7.7	12.1	2.7	7.8	1.1	4.6	1.6	23.7
2001	61.3	31.5	26.5	22.6	7.5	12.0	2.5	6.3	1.0	5.9	1.2	21.6
2002	61.1	35.8	26.6	20.4	7.7	11.8	2.5	7.1	1.1	5.8	1.0	19.0
2003	61.9	32.9	26.3	24.0	7.5	10.6	2.3	6.3	0.9	6.0	1.0	20.3
2004	61.9	32.0	26.0	21.9	7.8	12.6	2.2	5.8	1.0	6.7	1.2	21.1
2005	62.7	35.1	25.4	19.0	7.6	12.3	2.1	6.4	1.1	5.2	1.1	22.0
2006	64.2	35.5	24.9	18.6	6.6	10.3	2.2	6.6	0.9	5.8	1.0	23.2
2007	64.7	36.0	24.1	18.4	6.8	10.6	2.5	7.1	0.9	5.7	1.0	22.2
2008	66.0	38.3	23.5	18.1	6.4	9.5	2.2	7.1	1.0	5.6	0.9	21.4
2009	67.0	40.4	22.8	17.9	6.4	10.2	2.1	6.4	0.9	4.7	0.8	20.5
2010	67.5	40.3	22.4	18.3	6.4	9.7	2.0	6.6	0.9	5.2	0.8	19.8

The data include non-financial enterprises, towards which the exposure of banks providing credit facilities exceeds PLN 2 million.

Source: own study.

Table 3. Durability of single-bank relationships

year	t-1	t-2	t-3	t-4	t-5
1998	95.9				
1999	87.7	82.6			
2000	94.8	80.0	75.7		
2001	81.9	77.5	63.9	60.6	
2002	93.4	77.1	72.4	60.7	58.6
2003	94.1	86.6	70.2	65.8	56.4
2004	93.7	86.5	78.1	63.4	59.5
2005	92.8	84.5	78.2	71.6	58.2
2006	92.8	84.0	75.9	70.4	64.8
2007	86.1	78.2	70.4	64.5	60.1
2008	94.6	81.4	74.0	66.3	60.1
2009	95.5	88.5	76.7	68.8	61.7
2010	95.1	89.5	82.6	70.8	63.6

The table shows the percentage share of enterprises which:
- had a single-bank relationship in a given year
and
- also had a relationship with only one and the same bank the year before (column t-1), 2 years before (column t-2), etc.

For instance — among firms which had a single-bank relationship in 1999: 87.7% had a relationship with only a single bank also the year before, 82.6% also had a relationship only with this one bank 2 years before.
Only enterprises which were in the database in both analysed periods are taken into account.

Source: own study.

Appendix 2. Description of the model and estimation results

Table 4. Panel A — macro-variables

year	GDP change (in %)	nim	CR5	HHI	lb	aktb_pkb	roab	lgpw
1999	6.6	4	47.7	0.079076	77	59.1	0.9	221
2000	2.7	4	46.5	0.076136	73	59.2	1.1	225
2001	0.5	3.5	54.7	0.089419	69	61.8	1	230
2002	2.2	3.3	53.4	0.087696	59	57.7	0.5	216
2003	4.7	3.1	52.3	0.083016	58	58.0	0.5	203
2004	4	3.1	50.2	0.076490	57	58.2	1.4	230
2005	4.4	3.2	48.7	0.073029	61	59.7	1.6	255
2006	6.6	3.3	46.5	0.071468	63	64.4	1.8	284
2007	6.6	3.1	46.6	0.072136	64	68.0	1.8	375
2008	3.2	3.0	44.6	0.062060	70	85.0	1.5	458
2009	3.3	2.4	44.5	0.065841	67	82.0	0.8	486
2010	3.8	2.75	43.9	0.064997	70	82.0	1.1	585

Source: NBP, PFSA and own calculations.

Table 5. Table of correlations of variables — panel A

	lk	nplp	HHI	CR5	lb	nim	roab	lgpw	hightech	zagr	PKB	aktb-pkb
lk	1											
nplp	-0.0092	1										
HHI	-0.0305	0.1789	1									
CR5	-0.0197	0.1814	0.9146	1								
lb	0.0132	-0.1832	-0.5655	-0.6274	1							
nim	-0.0113	0.12	0.7174	0.7175	-0.1802	1						
roa	0.0343	-0.0465	-0.3704	-0.1814	0.0869	0.1216	1					
lgpw	0.0202	-0.1924	-0.8753	-0.8831	0.5553	-0.7665	0.2787	1				
hightech	0.0064	0.068	0.0627	0.0565	-0.0196	0.0588	-0.0242	-0.0638	1			
zagran	0.2252	-0.019	-0.0038	0.0033	-0.0082	0.0054	0.0237	-0.0004	0.0555	1		
PKB	0.0204	0.0439	-0.1401	-0.0897	-0.4566	-0.1377	0.5438	0.0861	-0.0228	0.017	1	
Aktb/PKB	0.0278	-0.2062	-0.9033	-0.8056	0.6799	-0.6794	0.323	0.9085	-0.0596	0.002	-0.0346	1

Source: own calculations.

Table 6. Diversification of the explained variable — panel A

Total variability	0.4799648
Between group variability	0.2959134
Within group variability	0.3723836

Source: own calculations.

Table 7. Panel A — basic statistics of variables

year		No of observations	lk	nplp	nplb*
1999	Mean	18,833	5,045.917	14.646	15.9076
	Standard Deviation		48,071.69	0.346415	15.86631
	Min		0	0	0
	Max		5,305,561	38.24053	100
2000	Mean	21,874	5,067.838	17.6251	19.1532
	Standard Deviation		44,027.15	0.423835	16.26596
	Min		0	0	0
	Max		4,906,411	211.7132	100
2001	Mean	22,680	5,186.148	23.7727	24.98892
	Standard Deviation		43,232.21	0.419852	17.10383
	Min		0	0	0
	Max		4,518,261	100.0006	100
2002	Mean	22,357	4,995.149	30.0239	32.16102
	Standard Deviation		31,689.5	0.452532	18.77899
	Min		0	0	0
	Max		1,605,729	100.1232	100
2003	Mean	23,405	4,902.986	32.3382	33.8905
	Standard Deviation		33,036.66	0.463188	20.08616
	Min		0	0	0
	Max		1,735,430	100	100
2004	Mean	22,459	4,867.611	24.695	22.26393
	Standard Deviation		29,733.97	0.427233	18.13393
	Min		0	0	0
	Max		1,636,510	100	100
2005	Mean	23,117	4,886.803	18.8775	14.69442
	Standard Deviation		30,613.9	0.388068	15.08236
	Min		0	0	0
	Max		1,672,580	100	100
2006	Mean	25,703	5,137.899	13.2169	9.257541
	Standard Deviation		33,806.06	0.335416	11.7928
	Min		0	0	0
	Max		2,376,191	100	100
2007	Mean	30,793	5,334.951	9.1219	6.253481
	Standard Deviation		33,613.15	0.284095	9.71584
	Min		0	0	0
	Max		2,786,907	100	100
2008	Mean	35,779	5,873.391	7.2911	6.160959
	Standard Deviation		42,749.05	0.255945	9.10171
	Min		0	0	0
	Max		4,395,883	100	100
2009	Mean	35,524	5,744.941	9.4257	10.04738
	Standard Deviation		40,547.73	0.286759	11.03561
	Min		0	0	0
	Max		4,167,259	100	100
2010	Mean	37,969	5,251.597	9.6251	9.910863
	Standard Deviation		34,121.49	0.29049	9.867466
	Min		0	0	0
	Max		3,517,422	100	100

Source: NBP and own calculations. *share of non-performing loans for individual industries.

Table 8. Panel A — estimation results and significance tests

		(1)	(2)	(3)[1]	(4)	(5)
size of exposure	lk	-.65825*** (.006353)	-.06111*** (.0145433)	-.63049 *** (.0152683)	-.66445*** (0146118)	-.68665*** (.0148565)
credit risk	nplp	1.1874*** (.0939739)	1.0125*** (.01954)	1.01912*** (.0343286)	1.2251*** (.0332193)	1.2325*** (.033634)
concentration/ competition in the banking sector	HHI	-2.9489*** (.054192)	-	-	-	-
	HHI^2	-	-26.032*** (.499247)	-	-	-
competition on the part of capital market	lgpw	-	-	-	-	1.10131*** (.0290204)
economic development	PKB	.012642** (.0057716)	-.00469 (.005909)	.055687*** (.0058232)	-	.046684*** (.0056709)
development of the banking sector	aktb_pkb	-	-	-	.03085*** (.0009639)	-
innovativeness	hightech	-	-	-.19661*** (.0457999)	-	-
form of ownership	zagran	.623542*** (.0274439)	.62131*** (.0461012)	.52978*** (.0485353)	.0461185*** (.0461185)	.65302*** (.046852)
control variables (characteristics of industries)	Us	.5243 (.0191982)	.52541*** (.0384873)	-	.00919*** (.0384849)	.51411*** (.039082)
	Tr	.0911 (.0345509)	.0888 (.0770593)	-	.52212 (.077036)	.12458 (.078273)
	Bud	.3394*** (.030823)	.3431*** (.0594074)	-	.0777 *** (.0594287)	.29856*** (.0603357)
	_cons	-3.67457 (.1435193)	-5.5158*** (.1455485)	4.0671*** (.1325039)	2.0097*** (.1336531)	-2.241*** (.1934697)
Value of credibility function		-59,250.462 (0.0000)	-59,252.707 (0.0000)	-53,680.292 (0.0000)	-59,273.247 (0.0000)	-58,997.11 (0.0000)
Wald test		chi2(24) = 3,911.2 (0.0000)	chi2(24) = 3,910.8 (0.0000)	chi2(24) =2,723.9 (0.0000)	chi2(24) = 3,878.8 (0.0000)	chi2(24) = 4,224.7 (0.0000)
AIC/BIC information criteria		118,520.9/ 118,617.4	118,525.4/ 118,621.9	105,270.4/ 105,423.2	118,564.5/ 118,651.3	118,013.6/ 118,110.1
Likelihood ratio test: rho=0****		chibar2(01)= 2.5e+04 (0.000)				

Source: own calculations. * — significant at the level of 10%, ** 5%, *** 1%, standard errors provided in brackets. Us — services, Tr — transport, Bud — construction. The variable specifying industrial processing has been removed due to colinearity (it constitutes the base level). [1]the data panel did not include firms from the construction industry (Bud). ****Rejection of the hypothesis rho=0 means that using the panel model is justified.

Table 9. Panel A — control of correctness of the results (1)

		(1)	(2)	(3)	(4)	(5)
size of exposure	lk	-.655143*** (.0145377)	-.652921*** (.0145185)	-.61692*** (.0142345)	-.58986*** (.0145306)	-.685764*** (.0148429)
credit risk	nplp	1.22253*** (.033281)	1.21726 *** (.0332482)	1.1915*** (.0332633)	1.22501*** (.0329703)	1.2402*** (.0335371)
concentration/ competition in the banking sector	CR5	-.097084*** (.0029432)				
	CR5^2		-.000973*** (.0000299)	-	-	-
	lb	-		2.3972*** (.1315557)	-	-
	nim	-	-		-.888602*** (.0262215)	-
	roab				-	-.17222*** (.0291157)
competition on the part of capital market	lgpw	-	-	-	-	1.13008*** (.0291157)
economic development	PKB	-	-	.09197 *** (.0059879)	-	-
form of ownership	zagran	.623542*** (.0461375)	.621314*** (.046097)	.6018*** (.0454529)	.624440*** (.0462602)	.624441*** (.0468338)
control variables (characteristics of industries)	Us	.524361 (.0385189)	.525410*** (.0384873)	.51495*** (.0379707)	.549455*** (.0386272)	.514951*** (.0390593)
	Tr	.091057 (.0771026)	.088880 (.0770392)	.023345 (.0759687)	.097987 (.077366)	.106224 (.0782062)
	Bud	.339441*** (.0594489)	.343131*** (.0593995)	.40334 (.0586066)	.326418*** (.059642)	.2940454*** (.0603106)
	_cons	8.700227*** (.2020612)	6.280588*** (.1522176)	-6.5939*** (.5615003)	6.79666*** (.1596366)	-2.2414*** (.1924635)

Source: own calculations. * — significant at the level of 10%, ** 5%, *** 1%, standard errors provided in brackets.

Table 10. Panel A — control of correctness of the results (2)

		(1)	(2)[1]
size of exposure	lk	-.69833*** .0151394	-.731843*** (.016342)
credit risk	nplp	1.115197*** (.0344596)	1.08479*** (.0194619)
innovativeness	hightech	-	-.111129** (.0483615)
forms of ownership	zagran	.6313174*** (.0479941)	.618368*** (.026984)
control variables	2001	-.144938** (.0490875)	-.120395** (.0511692)
	2002	-.115478* (.0495022)	-.137071* (.0516118)
	2003	.4398138*** (.0490665)	.4455662*** (.0511469)
	2004	.317012*** (.0499922)	.3180451*** (.0521232)
	2005	.4815298*** (.0496405)	.4785411*** (.0518318)
	2006	.5935254*** (.0490274)	.5903543*** (.0512696)
	2007	.3875255 *** (.0490274)	.4287337*** (.0512696)
	2008	.5423408*** (.0481308)	.5995026*** (.0496514)
	2009	1.059071*** (.0472145)	1.081105*** (.0494979)
	2010	1.558778*** (.0469707)	1.554292*** (.0500409)
	_cons	4.145872*** (.1313846)	4.441323*** (.1417306)

Source: own calculations. * — significant at the level of 10%, ** 5%, *** 1%, standard errors provided in brackets. [1]the data panel did not include firms from the construction industry.