Discrimination strategies: a case study for credit contracts

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Abstract This paper focuses on the financing strategy adopted by the European Bank for Reconstruction and Development in the period 1991-2003. We propose a simple empirical method to isolate the most effective screening device for contracts granted under conditions of asymmetric information. In line with the predictions of the contract theory, the role of memory is dominant. By exploiting the information about the number and type of contracts by client, we test different indicators to approximate the client's reputation. Our results unambiguously isolate the value of the first-investment project financed by the EBRD as the most effective screening device among the established clients. **JEL codes:** F34, G14, G21, P33.

Key words Fixed-effect technique, Financial contracts, Screening devices.

1 Introduction

The European Bank for Recostruction and Development (EBRD) was established in 1990 to assist the political and economic transformation of a group of post-socialist countries in Central and Eastern Europe. In a few chapters of the EBRD Creation Agreement, the promotors of this new institution identify that the main mode of action of the bank has to be the financing of individual projects mainly addressed to the private sector. This mission translated into a concern: financing investments (that would not otherwise be funded) with a catalytic power in the host economies. If there were a non-EBRD solution for getting credits, the clients would certainly avoid to involve the EBRD because its loan rates are not subsidized and projects require to impact on the economic transition process (Besley at al., 2010). In this respect, the mission of the EBRD is not to crowd out the private banking financing, but the bank operates in countries and for projects that no commercial bank would do. Therefore, *de jure et de facto,* the EBRD was established with a dominant position in financing investment projects to be run in transition countries. This exceptional situation makes the EBRD experience an interesting case study for two reasons. First, the management of risk had to be carried out in a very uncertain environment. The country risk was high owing to the macroeconomic turmoil. Furthermore, all potential borrowers lacked market experience and had no history of creditworthiness. Second, the decisions made by the EBRD were not affected by competition because local banks were insolvent and foreign banks did not enter these risky markets in the early transition period (Lanine and Vander Vennet, 2007).

Nevertheless, as any other credit institution, the EBRD was facing the problem to screen the clients and finance the project with the highest expected returns. Banks usually tend to maintain durable relationships with clients of established reputation. With repeated contracts the principal (here the *bank)* is able to learn from the agent's past history and, hence, to propose a contract that internalizes this information over time. The benefit is that risk sharing is improved (Stiglitz and Weiss 1981, 1983). It has been proven that, as a result of this learning process (known also as memory), a long-term credit contract benefits the borrower in the form of lower interest rates and fewer collateral demands (Boot and Thakor 1994). Other models, however, predict that the duration of the bank-borrower relationship increases the borrowing costs because a borrower pays for switching costs in starting a new relationship with another (competitor) bank (Greenbaum et al. 1989 and Sharpe 1990). These conflicting predictions are reproduced by the empirical literature. Berger and Udell (1995) and Bodenhorn (2003) find a negative relationship between duration of the bank-borrower relationship and borrowing costs or collateral demands. Degryse and Van Cayseele (2000) find, in contrast, that the loan rate increases with the duration of the bank-borrower relationship. Neither result is confirmed by other studies in which no statistically significant correlation is obtained (Blackwell and

Winters 1997, Petersen and Rajan 1994, Cole 1998 and Elsas and Krahnen 1998). This inconclusive empirical evidence illustrates that the borrowing conditions may not only be a function of the credit duration but also of other factors like the amount of credit, the riskiness of the project or the market structure. In addition, banks also use the borrowing cost to screen borrowers and to eliminate the ones with the highest probability of default (Stiglitz and Weiss 1981). Accordingly, the borrowing cost can vary between firms not only because of the duration of the relationship but also as a result of the banks' screening policy, and, in this respect, it also includes a reputation component associated with the memory effect.

The present paper proposes an empirical analysis of the specific case study of the EBRD. We aim at identifying the principal determinants of the EBRD lending policy mostly emphasizing the role of the learning process (namely memory as a proxy for reputation) as a screening device for granting credits. The monopolistic behavior of the EBRD offers ideal conditions to test memory in credit contracting. We build an original database from data made public by the EBRD on all its investments in private and public firms during the first years of its activity (1991-2003). The choice to focus on one single bank allows to control for unobserved heterogeneity in lending policy. Then, our dataset allows us to split contracts into two subsamples: firms that have signed one single contract and firms that have signed more than one contract. In so doing, we can develop an identification strategy to control for the screening effect. In both subsamples, the amount of lending and the type of contract set for each firm's first contract reflect the screening policy of the bank. In the subpopulation of several-contract firms information on the firms' past actions obviously exists. The question is: will the bank use it? We run regressions for each of the two subsamples. If the same results were obtained, this would mean that the bank does not use the past history of its clients in designing contracts. Our results clearly show that this is not the case. The total project value of the first signed contract (but not of the following ones) is neatly identified as the dominant individual fixed effect in the design of contracts for firms that have signed more than one.

The remainder of the paper is organized as follows. Section 2 focuses on the main theoretical contributions studying the bank-client relationship. Section 3 presents the econometric strategy and results and Section 4 concludes.

2 The choice of contract

The choice of the optimal contract between a lender and a borrower has been widely studied. Asymmetric information is the major source of risk between the two counterparts, and it is very difficult to control for. The lender aims at defining a device that allows her (i) to distinguish the good (solvent) borrower from the bad one and (ii) to choose the right incentives to force the borrower to put as much effort as possible into the completion of

the investment project for which credit is demanded. Therefore, the problem turns out to be the sum of various dimensions of uncertainty and imperfect information.

In a framework accounting for the repeated moral hazard problem between borrowers and lenders, Boot et al. (1991) conclude that, for borrowers with a good reputation, there is a unique equilibrium, in which each borrower is offered an unsecured loan contract. In contrast, borrowers with a bad reputation are offered a secured contract with collateral that is lost only upon default. When private information on borrower type is added, the problem turns out to be of an adverse selection type: agents are required to self-report. If borrower quality and effort are substitutes, low-quality borrowers post collateral in order to commit to higher effort. This action reduces the likelihood of default of low-quality borrowers but it still remains higher than that of the high-borrower quality. As a consequence, there is a deadweight loss associated with collateral. The private information problem accentuates the relationship between collateral requirements and borrower risk (already present in moral hazard problems). In the empirical test that Boot et al. (1991) propose, a key result deserves attention: a decrease in collateral costs or an increase in loan size yields a lower utilization of collateral at equilibrium. Larger loans are more likely to have a lower level of collateral as well as loans with longer maturity. The size of the loan can be interpreted as a signal of borrower quality. Other factors occurring in the client–bank relationship can also be interpreted as signals of the quality of the borrower, such as the structure of the contracts signed by the two counterparts. A bank can usually discriminate between clients by proposing different contracts to them. The contracts can be grouped by type according to their 'nature' but, nevertheless, each of them is often tailored to the client's needs.

Looking at the most widespread class of contracts, Inderst and Mueller (2006) investigate the optimality of debt versus equity contracts. Debt contracts are optimal when the lender is conservative and equity contracts are optimal when aggressive. Debt contracts are suitable for financing profitable projects that are likely to break even on public information alone, while less profitable projects are financed with equity. In addition, debts are proven to mitigate moral hazard and other problems that arise from asymmetric information. For instance, investments by small firms in tangible assets such as equipment or properties are expected to be financed with debts. Furthermore, these authors analyze the sub-optimality of a lender's decision to propose a contract (to a potential borrower) by choosing it from a menu of contracts after having observed (ex-ante) a public signal. The menu choice always creates a problem because a lender would always choose a contract ex-post optimal for her. Nevertheless, given that the lender optimally restricts herself to a single contract to avoid ex-post self-dealing, it is optimal to offer a single contract that the client accepts or rejects on the basis of the contract's conditions. There is no adjustment of the loan terms after the screening, and this guarantees the optimality of the decision. The authors

provide empirical evidence supporting this result. Loans are often granted at standardized terms and borrowers, in particular small firms, are often charged with the same rate of interest (because of an implicit same risk premium).

The screening process is a key tool for discriminating between clients but it is a real burden for the bank (Manove et al., 2001).[1] The process is costly, especially in a perfect competitive setting. Therefore, a bank always has a strong interest in proposing a contract with a high level of collateral and avoiding the screening stage. In this way, it is sure to discard low types. Manove et al. (2001) focus on the screening cost in the case where a bank is a monopolist in the credit market. The result shows that there is a big difference with respect to the standard competitive structure. In the case of a monopolistic bank, the bank's optimal strategy is to offer one unique contract and then to screen all projects. The motivation is straightforward: the structure of the credit market makes the demand quite inelastic and high interest rates do not lower the borrowing volume. The important factor is the market power of the bank, which is efficient under the conditions of asymmetric information. Throughout the screening process, information is generated at a cost to the bank. Therefore, the bank screens the clients, funds the better projects and covers its costs with higher interest rates. As an additional result, the high concentration of the credit market allows the bank to establish a closer long-term relationship with firms. As for the borrowers, the good ones have an incentive to distinguish themselves from the others by posting sufficient collateral. As described in the next section, the framework developed by Manove et al. (2001) perfectly fits the behavior adopted by the EBRD. In this theoretical framework, the reputation effect is crucial to building memory on clients, which, in the long run, turns out to be a discrimination device.

To our knowledge, these theoretical results have not yet been tested empirically. The obvious reason for this is that it is very difficult to identify a bank behaving as a monopolist in the credit market. Therefore, the case of the EBRD appears as the unique and can be used as a kind of natural experiment to investigate on the previous issue.

3 The EBRD-client relationship

When considering a potential client for a lending contract, the EBRD follows a very standard procedure (Vuylsteke, 1995). First, we consider the case of financing only an investment project. The bank and its client agree to sign the contract; then, the bank finances the firm, which makes the investment and pays back the loan (plus interest) to the bank.[2] Second,

[1] The importance of the screening process and its true value are confirmed in Keys et al. (2010).

[2] In this section, for the sake of simplicity, we intend 'loan' to mean any kind of credit contract the bank may propose.

we consider a more established bank-client relationship. The bank grants its first contract to a firm. Then, according to the behavior shown by the client, the bank can decide to finance or not a second project whenever the client applies for a second (or further) contract. The problem faced by the bank therefore becomes dynamic. In a repeated contract, two scenarios are possible depending on whether the two stages are independent or not. If the stages are independent, the final result is the sum of the results of two one-stage games. Such a contract is nevertheless an incomplete one. Chiappori et al. (1994) proved that a long-term relationship can outperform a succession of day-by-day agreements if the role of memory is taken into account. To obtain this result, the principal's objective function must be time-separable and the current behavior must affect the probability of the current outcome. Under these assumptions, the bank can write a long-term renegotiation-proof contract by adapting the terms of the contract in the second period with respect to the return of the firm's investment in the first period. The bank, therefore, remembers the return of the firm's first-period investment. The structure of such a contract is optimal: neither the principal (the bank) nor the agent (the firm) has an incentive to deviate. Our empirical exercise aims at identifying whether and to what extent reputation has an impact on the amount of credit granted by the EBDR to finance its clients' investment projects.

For the purposes of this study, we built an original database from data made public by the EBRD over time. Our database includes 1788 financial contracts signed by the bank with private and public clients from 1991 to 2003. It contains information in each case on the identity and nationality of the clients, the amount of the contract in ECU/Euros, the value of the investment project, the sector of investment, the year the contract was signed, the type of contract (loan, share, equity or guarantee), and other characteristics (old clients, private/public, macro-programs...). In *[Authors]* (2009) there is an extensive description the contents of the database. Three main categories of credit instrument can be distinguished: loan, guarantee, and share and equity contracts. Loans were the financial contract most frequently used by the EBRD between 1991 and 2003 (Table 1). A loan is generally considered as a short-term contract, lasting five years on average, and tailored to meet the particular requirements of the project. The credit risk is usually taken by the bank or partially syndicated to the market.

[Table 1 about here]

A loan may be securitized by a borrower's asset and/or converted into shares or may be equity-linked. The second important category of contract includes share and equity. Share-type contracts were mainly signed at the beginning of the EBRD's activity, while equity contracts represent a broader category of financial contracts including share contracts. An equity investment can be undertaken in various forms, including subscription to ordinary shares. When the EBRD takes an equity stake, it expects an appropriate return on its investment. The bank usually sells its equity investment on

a non-recourse basis, has a clear exit strategy and only takes a minority position.[3] The third category of credit instruments refers to guarantee contracts. They were used mainly at the end of our dataset period. Through this type of contract, the bank helps borrowers with gaining access to financial sources through the provision of guarantees (EBRD, 1999). However, the adoption of these contracts is not random. In the single-contract subsample, the probability of granting a loan increases with the size of investment or credit, while in the more-than-one-contract subsample, the probabilities follow a random walk instead. This difference in the distribution of probabilities may signal that the EBRD does not behave in the same way for a first contract as for a second (or further) contract. The bank certainly has less client information for a first contract than for a second and, hence, the first contract carries more risk. The bank should be likely to adjust its lending policy in the face of this higher risk. If so, we may formulate the hypothesis that the EBRD's lending policy does not consist of offering a formatted menu but rather of granting credits tailored on the basis of client information and possibly on the basis of whether it is for a first or further contract.

4 Empirical strategy

The EBRD selects one of the thirteen different available contracts (Table 1) when deciding to finance the investment project of a firm. The one selected should be the contract that reduces as much as possible the asymmetric information between the principal and the agent. The objective of the econometric analysis is to identify the screening device that enables the bank to discriminate credit granting among firms and to select the contract that will incite them to behave well. In particular, we want to verify whether the EBRD modifies its behavior when it signs one or several contracts with the same firm over time. If it does, as proved by Lambert (1983), Rogerson (1985) and Chiappori et al. (1994), this means that the bank uses the historical information (memory) about the firm to adjust the financing conditions in order to maximize its profits. In order to focus on this issue, we proceed first by splitting the whole population into two subpopulations: one-contract firms and several-contract firms. Historical information is available on the firms in the subpopulation of several-contract firms, and we want to check whether the bank uses this information. We apply the same independent variables to both subpopulations but allow for different specifications of the fixed-effect estimation techniques.

According to the level of significance of the fixed effects, we are able to check (i) the degree of heterogeneity that they account for and (ii) the importance of the reputation effect captured by an ad-hoc fixed effect in the case of established clients.

[3] Equity is considered to be a non-contingent contract.

4.1 Econometric specification

In order to run our econometric exercise, we match data referring to a few characteristics of the contracts signed by the bank with other data referring to the environment in which the investment project has been carried out. In this way, we take into account either the country-investment risk and the project risk. According to the general theoretical framework discussed in Section 2, the amount of the credit contract is supposed to be the result of a combination of the market conditions and the expected return of the investment.

The variables referring to the environment are: the measure of income level in the host market (GDP per capita), an indicator for political institutions (degree of democracy, DEM), time dummies and, finally, a dummy for public clients because a public client is more likely to be considered as a solvent client. Concerning the contract, in addition to the value of the credit (IV) granted by the EBRD to the firm, we consider the type of contract, the year it was signed and the return of the investment of that firm that can be approximated, for a solvent firm, by the value of its productive investment (IP, available in the database). This investment value is the minimum level of return of any successful productive investment by the firm, which corresponds to its capacity for repayment. When adopting this hypothesis, we are following and extending the results achieved by Holmström (1999) who proved that the investment decision, and the distinguishing characteristics of this investment, represent a way to disclose the unknown characteristics of an agent when working under the dynamics perspective of a reputation effect.

The maturity of a credit is different for each category of contract and the type of contract is an indicator approximating the credit maturity, as mentioned in Section 3. Finally, we know that the interest rate charged by the EBRD is equal to the LIBOR (London Interbank Offered Rate) plus a risk premium. The value of the LIBOR allows us to capture the current conditions of the financial markets. From the firm's point of view, the LIBOR is an indirect measure of the effort required to establish its reputation as being solvent. From the bank's point of view, any changes in the LIBOR will affect the credit supply to the firm. In addition, for the specific case of loan contracts, the LIBOR can also approximate the rate of return of the bank's investment.

As for the risk premium, the data from the EBRD are not available. However, this does not represent an obstacle for the issue we are studying even because the borrowing cost cannot be an unambiguous indicator of the type of borrowers (As argued in Section 2). In our exercise, we overcome this problem by introducing fixed effects, which control for the omitted variable bias.

[Box 1 about here]

We formulate the empirical model as follows. Our database is built considering each contract as a single entry: for each entry we record all the available information referring to it. Let us define the dependent variable (value of the granted credit) as $Y=(IV)$ and $\underline{X}=(IP, Public, DEM, Libor, GDP)$ as the vector of the independent variables. Each dependent variable (IV) is defined as $IV_{itjs,}$ with $i = firm$, $t = year$, $j = host\ country$, $s =sector$. Instead, our regressors are variables referring either to the firm (i.e. IP_{itjs} and $Public_i$) and to the host market (i.e DEM_{jt} and GDP_{jt}) as well as to the general credit conditions on financial markets (i.e. $LIBOR_t$). We also include an interaction term $(Dem_{jt} * year_t)$ between the democracy index and the time dummies. This term is meant to track the possible changes of the variable democracy over time in each country with strong implications, for instance, on the protection of property rights.[4] Therefore, the equation we consider can be defined as:

$$\begin{aligned} IV_{itjs} &= \alpha_0 + \beta_1 IP_{itjs} + \beta_2 Public_i + \beta_3 Dem_{jt} + \beta_4 Libor_t + \beta_5 GDP_{jt} \\ &\quad \beta_6(Dem_{jt} * year_t) + \varepsilon_{itjs}. \end{aligned} \tag{1}$$

Our database is not a true panel, but rather a pooling of independent cross sections over time. Hence, we need to control for heterogeneity problems As argued in Wooldridge (2006), this pooled structure implies that the dependent variable may have different distributions in different time periods and, to control for this, we need to introduce some time-fixed effects (μ_t). The same reasoning applies to the sector dimension, for which we include some sector-fixed effects (μ_s). In addition, as shown, for instance, in Baltagi (2008), we also need to include the unobservable time-invariant individual-specific effect (μ_i) to control for the heterogeneity problem as much as possible. Controlling for all these effects allows to decompose the error term (ε_{itjs}) in the following way:

$$\varepsilon_{itjs} = \mu_i + \mu_t + \mu_s + \nu_{itjs}, \tag{2}$$

where μ_i is the unobservable time-invariant individual-specific effect and ν_{itjs} denotes the remaining disturbances, which are now expected to be $IID(0, \sigma_\nu^2)$. By inserting the error decomposition into the previous equation, we obtain the following equation:

$$\begin{aligned} IV_{itjs} &= \alpha_0 + \beta_1 IP_{itjs} + \beta_2 Public_i + \beta_3 Dem_{jt} + \beta_4 Libor_t + \beta_5 GDP_{jt} \\ &\quad \beta_6(Dem_{jt} * year_t) + \gamma_1\mu_i + \gamma_2\mu_t + \gamma_3\mu_s + \nu_{itjs}. \end{aligned} \tag{3}$$

The choice of the variable μ_i turns out to be crucial for obtaining independence between the residuals and the dependent variable. In a standard

[4] We prefer to rely on this qualitative variable rather than other pure quantitative variables (as GDP_{jt}* year_{jt}) because more informative of the state-of-right in host countries.

panel effect, the variable μ_i would be simply identified with firm-fixed effects. However, because of the structure of the database, the adoption of firm-fixed effects is limited and we perform several estimations alternating different types of fixed effects. Then, we will refine these results by checking the efficiency in the estimation results by adopting the various categories of fixed effects. If any difference is unveiled, estimation results obtained by including different type of fixed effects should disclose complementary insights. It is therefore necessary to look for potential fixed-effect candidates, which do not introduce endogeneity distortions. The theoretical framework indicates the contract type as one of the possible ways to identify the fixed effects beyond the canonical firm-fixed effects. The contract type is in fact time-invariant according to the EBRD statements. In our exercises, the fixed effects (FE) will be alternatively identified by the following exogenous variables: the contract type granted at time t ($C13$) for all clients, and, for established clients obtaining more than one contract, the contract type signed by a firm at $t = 1(C13FIRST)$ or the value of the investment of the same firm financed at $t = 1$ ($IPFIRST$). Therefore, the specification used for the estimation can be written as:

$$IV_{itjs} = \alpha_0 + \beta_1 IP_{itjs} + \beta_2 DI_j + \beta_3 Dem_{jt} + \beta_4(Libor_t) + \beta_5 GDP_{jt} \quad (4)$$
$$+\beta_6(Dem_{jt} * year_t) + \gamma_1 FE_i + \gamma_2 Year_t + \gamma_3 Sector_s + \nu_{itjs}$$

[Table 2 about here]

Table 2 gives descriptive statistics for some of these variables for the overall period and for two specific years: 1993 and 2003. The dependent variable is the financing amount (IV_{itjs}) granted by the EBRD. This is one of the variables in the bank's profit function, which depends negatively on the riskiness of the project.[5] It reflects both the screening process and the incentive mechanism that take place between clients. The measure of political institutions is taken from the Polity IV project (2007). This is an index varying between zero (for an absolute autocracy) and ten (for a fully-fledged democracy).[6] In our population this index declines over time because the EBRD financed democracies of Central and Eastern Europe at the beginning of the transition and later started to finance autocratic countries from Central Asia. The variation of the LIBOR corresponds to the historical values of the credit market during the period.

According to the theoretical results discussed in Section 2, we expect that all independent variables in equation (4), except the LIBOR, will have a positive sign. An increase in the LIBOR implies a decrease in the amount of credit. In order to test the level of individual heterogeneity, we apply

[5] See Stiglitz and Weiss (1981) on credit rationing.

[6] Refer to the Polity IV website for details on the method according to which the scores are computed: www.systemicpeace.org/polity/polity4.htm.

the technique of pooled OLS versus fixed effects.[7] Then, we are refining the results for the selected time invariant fixed effects ($C13$, $C13FIRST$ and $IPFIRST$). By running a regression with $C13$ as fixed effects, we do not include any information about firms' historical track. When we introduce historical information on individual firms (using the $C13FIRST$ or $IPFIRST$ variables), it is possible to observe whether the past performance of firms affects the conditions of the contract proposed by the bank. If it does, we can conclude that the bank memorizes the past information and uses it to adjust the conditions of the future contracts for each individual firm.

4.2 Results

Our database contains all contracts signed by the bank during the period 1991-2003. In order to test the reputation effect, we run regressions separately for each group of firms (namely one-contract firms and several-contract firms).[8]. We proceed first by assessing whether the fixed effect model should be preferred to the pooled OLS (with the F-test) and to the random effect model (with the Hausman test). In all the regressions we control for heteroskedasticity by applying either the White or the cluster correction (by contract). Then, we test the different measures of time-invariant fixed effects.

4.2.1 One-contract firms This subpopulation includes 1269 contracts (referring to 1269 different firms). As each contract corresponds to a particular firm, we do not dispose of historical information about the bank-client relationship. Therefore we can only test one measure of fixed effects: the contract-fixed effects ($C13$). This is a qualitative variable that identifies each type of the thirteen contracts.

[Table 3 about here]

The results of the F-test and the Hausman test show that the fixed effect model should be preferred to the pooled and random effects models (Table 3). Still preferring the cluster-error correction version of the estimations, the contract-fixed -effect results disclose interesting insights. The fraction of the variance due to fixed effects (ρ) is particularly high (0.70). The estimate of ρ suggests that almost three-quarters of the variation in the amount of financing is related to the different types of contract (Baltagi, 2008 and Baum, 2006). In the fixed effect estimations, the coefficients of all the explanatory variables (when they are statistically significant) display the expected sign. The firm's repayment capacity (IP_{itjs}) is always highly significant. All dummy variables are always statistically significant. The public identity of

[7] The econometric estimations were computed with the Stata 10 package.
[8] Estimations for the whole sample can be found in [*Authors*, 2009].

a client turns out to be important because a public client may be considered by the bank as less risky than a private one, when granting just one credit (and this result differentiates this group of contracts from the full sample). The significance of the interaction term between democracy (DEM_{jt}) and the time dummy means that the more democratic a country is over time, the larger the size of the financing offered by the bank. This result either tends to confirm the official claim that the EBRD promotes democratic institutions in transition countries or means that a country moving to democracy (over time) offers more profitable investment opportunities.

To sum up, for the one-contract firms the contract-fixed turn out to be a good measure for identifying individual heterogeneity. Each contract signed by the bank is granted according to the individual characteristics of the client and the contract itself is a suitable device to control for incomplete information when signing a first contract with a firm that it has selected.

4.2.2 Several-contract firms This subpopulation includes 346 contracts and includes all firms that obtained more than one contract. Therefore, we have historical information on each individual firm and we can control for it. Given this characteristic, we would like to check whether the bank takes into consideration the historical track of a firm when signing more that a contract. If it does not, this means that the bank deals with firms of both subsamples in the same way, hence ignoring historical information in the subpopulation of several-contract firms. Thus, we repeat the previous exercise in its entirety for this subsample. In order to control for heteroskedasticity, we alternatively apply the White and the cluster corrections. The cluster correction is important for controlling the autocorrelation in the residuals because each firm appears more than once in the sample.

[Table 4 about here]

When including the canonical firm-fixed effects, such fixed effects are performing quite well (referring to the values of ρ), still having the cluster corrected model as the preferred ones. In case of being statistical significant, the regressors turns out to display the expected coefficient with the exception of the $PUBLIC_i$ variable that is associated with a negative one. It might be that, for repeated contracts, the public client does not enjoy a very good reputation. Rather they are identified in a negative manner because, for instance, they are not able to ran efficiently their investment projects and this could reduce their repayment capacity. However, in quantitative terms, the introduction of firm fixed effects does not strongly improve the goodness-of-fit of the estimations. Moreover, even following the estimation strategy adopted in previous sample for this subsample (namely, considering contract-fixed effects) we disclose an interesting difference: fixed effects by type of contract do not capture the individual heterogeneity as well as happened previously (Tables 4). First, the F-test is weakly significant or insignificant, while the Hausman test strongly rejects the random effect model. As a result, we conclude that the model with contract-type ($C13$)

fixed effects is not a quite robust estimation technique for this subpopulation, even though these estimations should be preferred to the pooled and random-effect estimations. This conclusion is reinforced by the low level of ρ (0.12) of these estimations.

We, therefore, need to look for other measures of fixed effects for controlling individual heterogeneity. One reasonable factor that can have an important impact on discrimination between clients is the client's reputation. As discussed by Boot and Thakor (1994), an established client may enjoy better conditions when signing various contracts with the same bank.

In our database, we are able to identify the potential reputation of a client by isolating the first type of contract and the value of the first investment (namely, the repayment capacity) for the firm that appears more than once in our database. Then, we match these values to the other (later) contracts signed by the same firm. In order to avoid endogeneity problems, first we run the estimations including all firms of the sub-sample and, then, we extract from this sub-sample of several-contract firms the entries that correspond to the first contract for all firms as well as the firms with more than one contract signed the same year (as first entry), because we are not able to determine their chronological order.

In this way, we are able to use the historical information included in this subsample by testing two measures of individual fixed effects defined previously: *C13FIRST* and *IPFIRST*. Each of these measures contains this historical information because it takes into account the information associated with the first contract signed by each firm (FIRST). The variable IPFIRST represents the project value of the first contract; the variable C13FIRST is the type of the first signed contract. The present exercise yields an important result: the fixed effects associated with the project value of the first contract are a good measure to account for individual heterogeneity in this subsample.

[Table 5 about here]
[Table 6 about here]

In Table 5, we present the results obtained by introducing the *C13FIRST*-fixed effects in the full sample of several-contract firms.[9] Estimation results remain almost unchanged if compared to those of the contract-fixed effects. Furthermore, these types of fixed effects are not more informative of the previous ones. Instead, in the sample composed just with second and further contracts (Table 6), contract (*C13*) fixed-effect estimations are not performing as well as in the previous cases and most of the regressors in this estimation are not significant. Instead, the adoption of fixed effect as the first type of contract granted to a firm (*C13FIRST*) improves the goodness-of-fit of the model and the statistical significance of the regressors is basically unchanged with respect to the case of adopting contract-fixed

[9] In this sample *IPIFIRST* cannot be introduced for endogeneity problems.

effects.[10] Nevertheless, whenever the project *value* of the first contract (*IP-FIRST*) is included as fixed effect, the value of ρ increases strongly [Table 6] as well as the statistical significance of the regressors included into the estimation. This last fixed-effect is a measure of the reputation for established clients and it is evidence of the presence of memory. The project value of the first contract is the historical information for the bank. It provides informative evidence about the ability of its managers in running investment projects and, knowing ex-post the rate of return of that operation, the bank is able to get an approximation of the effective credit-repayment capacity of the firm (namely reputation effect) for the credit the same firm is currently applying for. Instead, the type of the first contract (*C13FIRST*) is not so informative of the historical track of a client. In the estimation including *IPFIRST,* the project value (IP_{itjs}) is always statistically significant and the coefficient has the expected sign. Concerning the other variables, they gain part of their statistical significance (if compared with the previous exercise) and keep the expected sign. Again, being a public partner no longer has strategic importance. Once more, in the first battery of estimations, the absence of historical information about clients obliged the bank to rely on other available variables, for instance, public ownership to control for incomplete information. Once the bank is dealing with established clients, the previous public-status effect is replaced by a more specific client-reputation effect.

To conclude, the memory of the first contract overrides the incomplete information problem in the bank-client relationship. Memory thus allows the bank to discriminate between firms according to their individual historical characteristics and to offer tailored contracts in order to control risk better.[11]

5 Conclusions

The dataset we built from the European Bank for Reconstruction and Development allows us to focus on the strategy adopted by the EBRD in granting credits and its main determinants. The EBRD was in a situation of monopoly in many transition countries, especially at the outset of the transition process. Moreover, the EBRD's shareholders are sovereign and assigned to the bank its mission to foster and not to crowd out financial flows towards the private sector in these countries. Our results identify the role of memory in the bank's lending decisions when the firms have signed more than one contract. The common background of our empirical tests

[10] It deserves to be noticed that the ρ of the regression with $C13FIRST$-fixed effects is particularly high, if compared to the same value for the $C13$-fixed effect estimations.

[11] In this respect, as a further detail, it can be observed that the number of groups inside this subsample of contracts increases from eight to ninety-one as a result of the memory effect.

has been the identification of the mechanisms adopted by the bank to discriminate between clients and to offer them profitable contracts suitable for their type. According to our results, the EBRD's lending policy was a combination of its specific objectives in the former Soviet bloc and the constraints associated with the information on clients. The need to cope with high credit risk unambiguously forced the bank to adopt measures of protection by using a client-screening scheme. As discussed in the economic literature, there is no unique scheme available to be implemented. In our sample, a screening device as general as the type of contract turned out to be an efficient tool, especially when considering the one-contract subsample of data. The importance of the cluster correction in the absence of memory effects may indicate that the EBRD probably designed various types of contract, each one tailored to the market conditions of a specific sector. Then, the bank offered these contracts to clients who wanted to invest in a particular sector and country.

Our exercise provides useful insights about the EBRD strategies. We were able to perform an econometric analysis confirming a few relevant predictions discussed in contract theory. Unfortunately, data at hand lack of sufficient information to evaluate the precise returns of the financed investments and, eventually, measure their economic impact in host countries. The availability of this missing information would yield further interesting conclusions. First, we could refine the structure of the exercise we proposed by bettering the measurement of a few variables. Second, controlling for the rate of success of the financed projects, it would be possible to bring more insights about the possible association between the optimality of the credit-screening process and the effective impact of financed investments on host-market economies.

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References

1. [*Authors*] (2009) "*Memory in contracts: the experience of the EBRD*", Working papers wpdea 1002 (available at IDEAS-Repec).
2. Baltagi, B. (2008): "*Econometric Analysis of Panel Data*", Wiley & Son, 4th edition, Chichester.
3. Baum, Ch. (2006):"*An introduction to Modern Econometrics using Stata*", STATA Press, College Station.

4. Berger, A.N. - Udell, G.F. (1995):"Relationship Lending and Lines of Credit in Small Firm Finance", *Journal of Business*, vol. 68, pp. 351-381.
5. Besley, T, Dewatripont, M and Guriev, S. (2010): "*Transition and transition impact",* Report for the EBRD's Office of the Chief Economist.
6. Blackwell, D. W, Winters, D.B. (1997):"Banking Relationships and the Effect of Monitoring on Loan Prices", *Journal of Financial Research*, vol.20, pp. 275-289.
7. Bodenhorn, H. (2003):"Short-Term Loans and Long-Term Relationships: Relationship Lending in Early America", *Journal of Money, Credit and Banking,* vol.35*,* pp. 485-505.
8. Boot, A.W.A, Thakor, V.A. (1994):"Moral Hazard and Secured Lending in an Infinitely Repeated Credit Market Game", *International Economic Review, vol.35(4),* pp. 899-920.
9. Boot, A. W. A, Thakor, A.V., Udell, G.F.(1991):"Secured Lending and Default Risk: Equilibrium Analysis, Policy Implications and Empirical Results", *Economic Journal,* vol 101(406), pp. 458-472.
10. Chiappori, P. A., Macho Stadler, I., Rey, P., Salanié, B. (1994):"Repeated Moral Hazard: The Role of Memory, Commitment, and the Access to the Credit Markets", *European Economic Review*, vol.38, pp.1527-1553.
11. Cole, R. A. (1998):"The Importance of Relationship to the Availability of Credit", *Journal of Banking and Finance,* vol.22, pp. 959-977.
12. Degryse, H., van Cayseele, P. (2000):"Relationship Lending within a Bank-Based System: Evidence from Small Business Data", *Journal of Financial Intermediation,* vol.9*,* pp. 90-109.
13. EBRD (1999): "*Financing EBRD"*, EBRD Press, London.
14. Elsas, R., Krahnen, J. P. (1998):"Is Relationship Lending Special? Evidence from Credit-File Data in Germany",*Journal of Banking and Finance,* vol.22, pp. 1283-1316.
15. Fang, Y., Hasan, I., Marton, K. (2011): "Bank efficiency in South-Eastern Europe", *Economics of Transition*, vol. 19(3), pp. 495-520.
16. Greenbaum, S., Kanatas, G., Venezia, I. (1989):"Equilibrium Loan Pricing under the Bank Client Relationship",*Journal of Banking and Finance*, vol.13, pp. 221-235.
17. Holmström, B. (1999): "Incentive problems: A Dynamics Perspective", *The Review of Economics Studies,* vol.66 (1), pp. 169 -182.
18. Inderst, R., Mueller, H.M. (2006):"Informed Lending and Security Design",*Journal of Finance,* vol. LXI (5), pp. 2137-2162.
19. Keys, B., Mukherjee, T., Seru, A., Vig, V. (2010): "Did securization lead to lax screening? Evidence from sub-prime loans", *Quarterly Jouernal of Economics,* vol. 125(1), February, pp. 307-362,
20. Lambert, R.A.(1983): "Long-Term Contracts and Moral Hazard",*The Bell Journal of Economics*, vol.14 (2), pp.441-452.
21. Lanine, G., Vander Vennet, R. (2007): "Microeconomic determinants of acquisitions of Eastern European banks by Wester European banks", *Economics of Transition*, vol. 15(2), pp. 285-308.
22. Manove, M., Padilla, A.J.,Pagano, M. (2001): "Collateral versus Project Screening: A Model of Lazy Banks', *The RAND Journal of Economics,* vol. 32(4), pp. 726-744.
23. Petersen, M.A.,Rajan, R.G. (1998):"The Benefits of Lending Relationships: Evidence from Small Business Data",*Journal of Finance,* vol.50, pp. 1113-1146.

24. Polity IV project (2007), www.cidcm.umd.edu/polity/.
25. Rogerson, W. (1985):"Repeated Moral Hazard",*Econometrica*, vol.53, pp. 69-76.
26. Sharpe, S. (1990):"Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Costumer Relationships",*Journal of Finance,* vol.45, pp. 1069-1087.
27. Stiglitz, J., Weiss, A.(1981):"Credit Rationing in Markets with Imperfect Information",*American Economic Review,* vol. 71(3), pp. 393-410.
28. Stiglitz, J., Weiss, A.(1983):"Incentives Effects of Terminations: Applications to the Credit and Labor Markets",*American Economic Review,* vo. 73, pp. 912-927.
29. Vuylsteke, Ch. (1995): "The EBRD: its mandate, instruments, challenges and responses", *MOCT-MOST: Economic Policy in Transitional Economics,* vol. 5(2), pp. 129-155.
30. Wooldridge, J. (2006):"*Introductory Econometrics. A Modern Approach"*, 3rd edition, Thomson South-Western.

LIST OF TABLES

Table 1: EBRD contracts and their frequency (1991-2003)
(Source: EBRD, Calculus: authors)

Contract	**Freq.**	**%**
Debt	1	0.06
Equity	141	7.92
Guarantee	100	5.62
Line of Credit	7	0.39
Loan	949	53.31
Loan/Line of credit	1	0.06
Loan/Shares	96	5.39
Loan/Guarantee	1	0.06
Senior debt	72	4.04
Shares	404	22.70
Shares/Loan	2	0.11
Shares/Loan/Share	1	0.06
Share/Loan/Guarantee	1	0.06
Subordinated debt	4	0.22
TOTAL	**1780**	**100**

BOX 1: LIST OF VARIABLES

C13	Type of contract signed by the EBRD (13 possible contracts)
DEM	Index of democratic level in the country hosting the investment (Polity IV, 2007)
PUBLIC	Dummy variable for presence of a public client or other interests of the bank in the project
DSY	Dummy for investments financed by the EBRD for the same firm in the same year
GDP	Gross domestic product per-capita of the host country (IMF statistics, 2007)
IP	Total value of the investment project
IPDSY	Value of projects for firms obtaining more than one credit in the same year
IV	Value of the investment financed by the EBRD
Libor	Average annual value of LIBOR interest rate at 12 months.
FIRST	Dummy for the first contract signed by the EBRD with firms obtaining more than one credit
Sector	Dummy by sector
Year	Time dummy
C13FIRST	Interaction term between C13 and FIRST
C13IPFIRST	Interaction term among C13, IP and FIRST
IPFIRST	Interaction term between IP and FIRST

Table 2: Descriptive statistics

	Variable	Obs	Mean	Std. Dev	Min	Max
Sample						
	Libor	1788	4.23	1.45	2.17	9.91
	GDP per-capita ($)	1706	2706.5	2143.6	151.48	13937.4
	Polity IV index (DEM)	1662	6.5	2.85	0	10
	EBRD Credit Value (€ mill.)	1766	16.5	24.2	0	233.7
	Total project value (€ mill.)	1750	49.23	97.87	0	1028.9
	Financing share	1728	0.6	0.33	0.009	1
1993						
	Libor	71	7.24	0	7.24	7.24
	GDP per-capita ($)	68	2167	1519.7	225.8	6801.8
	Polity IV index (DEM)	68	7.32	2.45	0	10
	EBRD Credit Value (€ mill.)	71	20.36	23.9	0.1	100.12
	Total project value (€ mill.)	71	69.98	96.95	1.3	464.7
	Financing share	71	0.43	0.28	0.04	1
2003						
	Libor	272	2.17	0	2.17	2.17
	GDP per-capita ($)	260	3292.8	2539.6	248.2	13937.4
	Polity IV index (DEM)	254	6.61	3.04	0	10
	EBRD Credit Value (€ mill.)	270	13.69	23.7	0.1	230.2
	Total project value(€ mill.)	271	33.26	77.4	0.1	750
	Financing share	270	0.69	0.34	0.01	1

Table 3
Econometric results: One-contract firms
Method of estimation: Fixed effects, Value in brackets: Std Error,
Dependent variable: IV

	OLS	**OLS**	**Fixed effects**	**Fixed effects**
C	8.59 (9.13)	8.72 (6.02)	-8.78 (-0.57)	5.78 (4.86)
IP	0.15 (0.09)***	0.15 (0.008)**	0.15(0.006)***	0.15 (0.007)***
PUBLIC	7.99 (2.74)***	7.98 (2.58)***	7.12 (2.04)***	7.09 (1.80)***
Dem	dropped	dropped	dropped	dropped
Libor	-0.515 (1.35)	-0.52 (0.24)**	3.94 (2.82)	-0.005 (0.16)
GDP	0.0004 (0.0003)	0.0004 (0.0003)	0.0004 (0.0003)	0.0004 (0.0003)
Dummy years	yes	yes	yes	yes
Dummy sectors	yes	yes	yes	yes
DEM*years	yes	yes	yes	yes
Fixed effects			C13	C13
Tests:				
Hausman Test (χ^2)			17.18***	
F-test: fixed vs pooled			4.57***	
D. Years=0	1.11	1235***	0.98	3.2 e^{05}***
D. Sectors=0	2.24**	23042***	1.73**	11926***
DEM*year=0	1.56*	9070***	1.82**	772,21***
DEM*year=D. Years	1.40	6626***	0.81	35126***
$\boldsymbol{\sigma_u}$			28.63	28.17
$\boldsymbol{\rho}$			0.71	0.71
Robustness errors	White	Cluster	White	Cluster
R-Square (within)	0.51	0.07	0.49	0.49
OBS	1269	1284	1265	1265
Groups			13	13

*** 1% significance level; ** 5%; * 10%

Table 4
Econometric results: Several-contract firms
Method of estimation: Fixed effects (with error correction), Value in brackets: Std Error,
Dependent variable: IV

	Fixed effects	**Fixed effects**	**Fixed effects**	**Fixed effects**
C	1.43 (10.39)	13.43 (7.60)*	14.91 (32.75)	14.91 (20.76)
IP	0.21 (0.03)***	0.21 (0.03)***	0.17 (0.017)***	0.17 (0.03)***
PUBLIC	1.14 (4.57)	1.14(4.36)	-11.85 (4.19)***	-11.86 (5.68)**
Dem	dropped	dropped	dropped	dropped
Libor	-5.34(4.43)	-5.34 (3.04)*	-3.13 (6.38)	-3.13 (3.11)
GDP	0.0009(0.0004)**	0.0009(0.0004)*	0.0003 (0.0005)	0.0003 (0.0003)
IPDSY	0.34 (0.12)***	0.34 (0.11)***	0.37 (0.04)***	0.36 (0.13)***
Dummy years	yes	yes	yes	yes
Dummy sectors	yes	yes	yes	yes
DEM*years	yes	yes	yes	yes
Fixed effects	C13	C13	Firm	Firm
Tests:				
Hausman Test (χ^2)	18.32***			
F-test: fixed vs pooled	1.85*		4.04***	
D. Years= 0	1.7*	2.05**	1.36	1.41
D. Sectors=0	3.15***	3.22***	1.56	156.71***
DEM*year=0	1.68*	2.42***	1.62*	9.82***
DEM*year=D. Years	1.49	2.81***	2.33**	5.73***
$\boldsymbol{\sigma}_u$	4.21	4.21	13.84	13.84
$\boldsymbol{\rho}$	0.12	0.12	0.77	0.77
Robustness errors	White	Cluster	White	Cluster
R-Square (within)	0.48	0.65	0.65	0.65
OBS	346	346	346	346
Groups	8	8		

*** 1% significance level; ** 5%; * 10%

Table 5
Econometric results: Several-contract firms
Method of estimation: Fixed effects (with error correction), Value in brackets: Std Error,
Dependent varibale: IV

	Fixed effects	**Fixed effects**
C	22.51 (9.04)**	22.51 (7.00)**
IP	0.21 (0.03)***	0.21 (0.03)***
PUBLIC	1.11(4.03)	1.11(3.87)
Dem	dropped	dropped
Libor	-6.40 (3.68)*	-6.40 (2.65)**
GDP	0.0008(0.0004)*	0.0008(0.0004)*
IPDSY	0.38 (0.12)***	0.38 (0.12)***
Dummy years	yes	yes
Dummy sectors	yes	yes
DEM*years	yes	yes
Fixed effects	C13FIRST	C13FIRST
Tests:		
F-test: fixed vs pooled	2.73*	
D. Years= 0	2.27**	2.73***
D. Sectors=0	3.09***	2.80***
DEM*year=0	1.93**	3.02***
DEM*year=D. Years	2.11**	4.30***
σ_u	5.51	5.51
ρ	0.19	0.19
Robustness errors	White	Cluster
Adj. R-Square	0.66	0.66
OBS	346	346
Groups	8	8

*** 1% significance level; ** 5%; * 10%

Table 6
Econometric results: Second and further contracts
Method of estimation: Fixed effects, Value in brackets: Std Error,
Dependent variable: IV

	Fixed effects	**Fixed effects**	**Fixed effects**
C	-3.65 (17.63)	2.99 (11.94)	98.91(26.82)***
IP	0.19 (0.017)***	0.19(0.02)***	0.63(0.20)***
PUBLIC	-5.99 (6.98)	-4.07 (6.56)	-20.50 (6.84)***
Dem	dropped	dropped	dropped
Libor	1.90 (2.42)	1.42 (2.33)	-2.45 (1.41)*
GDP	0.002 (0.0006)**	0.001 (0.0006)**	-0.003 (0.002)
Dummy years	yes	yes	yes
Dummy sectors	yes	yes	yes
DEM*years	yes	yes	yes
Fixed effects	C13	C13FIRST	IPFIRST
Tests:			
F-test: fixed vs pooled	0.94	3.27***	4.42***
D. Years=0	0.84	2.23**	2.56**
D. Sectors=0	0.64	1.79**	7.35***
DEM*year=0	0.86	2.11**	11.11***
DEM*year=D. Years	0.72	2.86**	9.80***
σ_u	3.32	15.49	76.23
ρ	0.07	0.64	0.99
Robustness errors	White	White	White
R-Square (within)	0.59	0.60	0.81
OBS	190	190	179
Groups	6	7	91

*** 1% significance level; ** 5%; * 10%

A Appendix: List of sectors

The following table shows all the sectors that firms asking for a finance belong to:

Banking, Finance and holding	Local services (water, waste...)
Chemical (including Pharmaceutical)	Media
Education and other public services	Manufacturing
Electronic and Hi-Tech	Metal
Energy	Natural resources
Environment	Oil and gas
Food and beverage (incl. agriculture)	Real estate
Health and personal care	Telecommunication
Hotels and tourism	Trade and retail
Infrastructure (transport)	Vehicles