Innovation and export in SMEs: the role of relationship banking.

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Abstract

This paper assesses the role of relationship lending in explaining simultaneously the innovation activity of Small and Medium Enterprises (SME), their probability to export (i.e. the *extensive margin*) and their share of exports on total sales conditional on exporting (i.e. the *intensive margin*). We adopt a measure of informational tightness based on the ratio of firm's debt with its main bank to firm's total assets. Our results show that the strength of the bank-firm relation has a positive impact on both SME's probability to export and their export margins. This positive effect is only marginally mediated by the SME's increased propensity to introduce product innovation. We further discuss the financial and non-financial channels through which the intensity of bank-firm relationship supports SMEs' international activities.

JEL Classification: F10, G20, G21, O30.

Keywords: margins of export, bank-firm relationships, innovation, localized knowledge spillovers.

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1. Introduction

Opening up new markets and widening the geographical space of commercial activities are key strategic choices to sustain firms' growth (Grossman and Helpman, 1991; Eaton and Kortum, 2001; Bustos, 2011). This is particularly true for small and medium sized enterprises (henceforth SMEs) whose initial approach to foreign markets typically occurs through exports. Yet, internationalization poses several challenges, which need to be appropriately supported by dedicated resources.

The decision to export does not imply a simple extension of current production and distribution activities, it rather requires the firm to properly select the target foreign market, to tailor its products in order to fit local tastes and needs and to adjust to different regulatory environments (Bugamelli and Infante, 2003). These efforts represent sunk investments, which differ according to the type of product and the features of the targeted foreign market (Helpman et. al, 2008; Chaney, 2013), and crucially require the firm to expand its set of competences.

Expanding beyond national borders, moreover, implies greater information asymmetries between the firm and its lenders, because firms assets and business become more opaque to potential financiers, due to an increase in the amount of intangible capital vis a vis tangible capital, which furthermore takes place abroad, possibly in a distant and risky context for the domestic lender. Credit rationing issues might therefore become more severe when additional financial resources are needed (Minetti and Zhu, 2011) and a stronger relationship between exporting firms and their lenders (informational tightness) may contribute to mitigate such information asymmetries (Berger and Udell, 1995).

A large body of empirical literature has also highlighted that internationalization is strongly linked to innovation activities[1]. Research and Development (R&D) investments or innovation outputs are likely to influence a firm's decisions to enter and expand into foreign markets by providing adequate resources and competences[2], as well as experience in international markets may foster firm's R&D effort and promote innovation through learning effects (see, for example, Bustos, 2011). As innovation-related investments are also prone to severe credit inefficiencies (Aghion et al., 2012;

[1] One of the first contributions on the positive relation between exports and innovation is Hirsch and Bijaoui (1985).

[2] Among the most recent papers, Cassiman and Golovko (2011) show that product innovation has a positive impact on the decision to enter a foreign market for a sample of Spanish SMEs.

Mancusi and Vezzulli, 2014), the potentially positive role of informational tightness between the firm and its bank could significantly affect the success of both strategies.

Previous empirical research provides evidence of the importance of informational tightness (usually measured with the duration of the credit relationship) in affecting either firm's innovativeness (Herrera and Minetti, 2007) or its foreign markets sales (Minetti and Zhu, 2011). However, to the best of our knowledge, previous studies have not yet analyzed the effect of relationship banking on innovation *and* export, accounting for the simultaneous relationship between the two activities.

Our contribution to the literature is twofold. First, we examine the effect of relationship banking on firm's internationalization through export, allowing innovation to be an endogenous determinant of export and itself affected by informational tightness. Our econometric approach allows us to separate and evaluate the direct and indirect (through innovation) effect of relationship banking on both the decision and the intensity of export. Second, we adopt a more effective proxy for the intensity of firm-bank relationship, developed on the basis of the literature on delegated monitoring (Diamond, 1994) and the "liquidity-concentration" trade-off theory on privately held firm control (Bolton and Von Thadden, 1998). Following Elsas (2005), our measure is based on the main bank's share of debt financing, which we further standardize by the firm's debt to total asset ratio. The literature suggests (Elsas, 2005) that this measure may be a better proxy for relationship lending than other measures used in the literature such as the duration of a bank–borrower relationship. We further show (see Appendix A) that this measure better correlates with the concept of relationship banking proposed by Boot (2000).

Our empirical analysis is based on a sample of 4341 Italian SMEs observed between 2004 and 2009. The sample is derived from two large scale surveys collecting extensive firm level information on SME's innovation, export activities and informational ties with their lenders: the 10th UniCredit Corporate Survey on manufacturing firms (UCS) and the 1st survey on European Firms in a Global Economy (EFIGE). Italy represents an ideal setting for our analysis because of the key role of banks in firms' financing (Beck et al., 2008) and the critical role of SMEs for its economy (Ayyagari et al., 2008).

Our results confirm the hypothesis of self-selection into export by showing that the firm's ability to introduce innovative products is a key determinant of both the decision to export (the extensive margin) and the share of export on total sales (the

intensive margin). We further show that the strength of the bank-firm relationship has a positive impact on both export margins, thus confirming that informational tightness can help overcoming credit constraints and support internationalization strategies. Moreover, in line with the results of Herrera and Minetti (2007), we find that our measure of informational tightness also significantly affects the probability to introduce product innovation. However, the direct effect of relationship lending on export is stronger than the one on innovation: a one standard deviation increase of the firm-bank relationship increases the propensity to export by +24.72%, against an estimated +3.08% marginal effect on the propensity to introduce innovative products. As a consequence, the positive effect of bank-firm informational tightness on the internationalization of SMEs is only weakly exerted through the promotion of product innovation, and thus suggests an active role of the main bank in providing support services to export activities together with financing resources.

We further explore the potential channels through which the positive effects of relationship banking on the extensive and intensive margins of export realize. Although constrained by data availability, our analysis suggests that both financial and non-financial channels are likely to be at work. The financial channel works by reducing firm's credit constraints, whereas the non-financial channel operates through alternative intermediation services that the bank may provide to support SMEs' international activities.

The paper is organized as follows. Section 2 reviews the related literature. Section 3 discusses the econometric model that links innovation, export and the intensity of the bank-firm relationship. Section 4 describes the data and the main variables used for the analysis. Section 5 discusses the most important econometric results and Section 6 concludes.

2. Related literature

This paper builds upon different streams of literature: the literature on the effects of financing constraints and the role of relationship banking for export, the literature on the relationship between export and innovation and the literature studying the beneficial effects of relationship banking on innovation.

The first line of research focuses on the effects of credit constraints on firm internationalization and has been rapidly growing over the last years (see, among the others, Greenaway et al, 2007; Bellone et al, 2010; Minetti and Zhu, 2011). This literature

is grounded in the new international trade theories with heterogeneous enterprises. It maintains that the causal relationship between financing constraints and export consists of a self-selection mechanism, by which high sunk cost thresholds prevent constrained firms from participating to international markets (Bellone et al. 2010; Manova et al., 2011), and of the presence of high variable trading costs hampering the firm's intensive margin of export (Manova, 2013).

Related to these, a still limited number of papers have studied the role played by banks in influencing the ability of SMEs to access foreign markets by analyzing how a close firm-lender relationship can help to overcome market failures originating from informational asymmetries and to alleviate the detrimental effects of financing constraints. The empirical evidence has however been rather mixed. Minetti and Zhu (2011) show that limited access to liquidity has a negative impact on a firm's export, but also find that the duration of the relationship with the main bank (a commonly used measure of the intensity of bank-firm relationship) does not seem to affect the firm's extensive margin of export. De Bonis et al. (2010) find that a longer relationship with the main bank fosters Italian firms' foreign direct investment (FDI) and, weakly, production off-shoring abroad. By contrast, with the exclusion of small-sized companies, they detect no impact on firm's propensity to export.

More recent contributions have also tested the hypothesis that the positive effect of relationship banking on export can be associated to non-financial services that banks may provide in support of firm's exporting activities (Del Prete and Federico, 2014).

The second line of research focuses on the circular link between innovation and exporting. The starting point is a strong empirical regularity: exporters tend to outperform non-exporters (Mayer and Ottaviano, 2007). The direction of causality (is productivity increasing export or does export increase productivity?) is however still not clear. On the one hand, innovation may foster firm's productivity and therefore promote export: this is the so-called self-selection hypothesis (Melitz, 2003). On the other hand, knowledge flows from international buyers and competitors may help to improve the innovation performance of exporters. This is the so-called learning by exporting hypothesis, according to which export feeds back into innovation (Costantini and Melitz, 2007). A major challenge in the evaluation of the causal impact of innovation on a firm's export status and intensity is therefore to address this endogeneity concern.

The two hypotheses are clearly not mutually exclusive, but rather likely to be both at work, although the previous empirical contributions mostly focus on one of the

two sides of the innovation-export relationship. Most of the existing evidence has focused on product innovation and seems to be in favour of the selection into export hypothesis, which is confirmed in a number of empirical analyses. Among these, Cassiman and Golovko (2011) show that product innovation has a positive impact on the decision to enter a foreign market.[3] By contrast, there is no clear support for the alternative hypothesis of learning by exporting (Damijan et al., 2010; Bustos, 2011; Bratti and Felice, 2012).

The last line of research relevant for our analysis focuses on financing constraints, the role of relationship banking and innovation. A number of papers have recently shown the negative effect of credit rationing on R&D investment (Aghion et al., 2012; Mancusi and Vezzulli, 2014) and innovation (Savignac, 2008). As argued in Herrera and Minetti (2007), banks have sound incentives and ability to collect information on borrowers fostered by their concentrated nature and their emphasis on relationship lending. These authors show that informational tightness (measured by the duration of the credit relationship between the firm and its main bank) has a positive effect on the probability that the firm innovates, this effect being more significant for product than for process innovation. In a broader perspective, Benfratello et al. (2008) show that banking development (measured by branch density) affects the probability of process innovation, particularly for small firms in high-tech sectors, while evidence on product innovation is much weaker and not robust.

3. Econometric model

3.1 Firm's export equations

Our econometric approach extends the models of Herrera and Minetti (2007) and Minetti and Zhu (2011) by trying to disentangle the direct effect of relationship banking on both the firm's probability of exporting (*extensive margin*) and its export share (*intensive margin*) vs. the indirect benefits exerted through the promotion of product innovation.

Let π_i^* represent the difference between firm *i*'s operating profits when exporting a given percentage of sales and its operating profits when not exporting:

[3] It is also worth mentioning the works of Costantini and Melitz (2007) and Van Beveren and Vandenbussche (2010), who study how firms may self-select into innovation in anticipation of their entry into export markets.

$$\pi_i^* = R(export\_share_i^*) - C(export\_share_i^*) - K \quad (1)$$

where *R* and *C* are, respectively, the expected revenues and variable costs (both depending on the share of export over total sales, $export\_share_i^*$) and *K* is the fixed cost of entering a foreign market (possibly including the cost for developing a new innovative product).

Given this setting, we observe an exporting firm when $\pi_i^*>0$ for some levels of $export\_share_i^* > 0$ and the expected percentage of sales exported will be the one which maximizes (1). When the optimal level of exported sales exceeds the productive capacity of firm *i,* we shall observe $export\_share_i^* = 100$.

In our econometric specification we assume the optimal percentage of exported sales to depend mainly on a set of firm's specific characteristics *X* (size, availability of internal liquidity, etc.)[4], its propensity to innovate and the strength of the credit relationship with the main bank:

$$export\_share_i^* = \gamma_0 + \gamma_1 rel\_bank_i + \gamma_2 innoprod_i + \gamma_3 X_i + \varepsilon_i \quad (2)$$

where *rel_bank* is a measure of the strength of the credit relationship between firm *i* and its main lending bank (see Section 4.2), *innoprod* is a binary variable equal to 1 if the firm has introduced at least one innovative product, *X* is a vector of exogenous control variables (see Section 4.5), γ_0, γ_1, γ_2 and γ_3 are the unknown parameters to be estimated and ε is an unobservable error component assumed to be normally distributed and encompassing all latent factors affecting the firm's optimal exporting share.

We then model the firm's exporting decision using a Probit specification, where Φ is a standard normal cumulative density function:

$$\begin{aligned} \Pr(export_i = 1) &= \Pr(export\_share_i^* > 0) \\ &= \Pr(\gamma_0 + \gamma_1 rel\_bank_i + \gamma_2 innoprod_i + \gamma_3 X_i + \varepsilon_i > 0) \\ &= \Phi(\gamma_0 + \gamma_1 rel_{bank_i} + \gamma_2 innoprod_i + \gamma_3 X_i + \varepsilon_i) \end{aligned} \quad (3)$$

[4] We also tried to include in X an indicator of firm's labour productivity, computed as the ratio of firm's value added over the number of employees (full time equivalent). In all our specifications this indicator was never found significant, so we decided to drop it from the analysis. Although it might seem somewhat surprising, this result is consistent with findings in previous studies such as Todo (2011) and Inui et al. (2013), which show that TFP is not relevant in explaining the export decisions.

and the observed percentage of exported sales using a Tobit specification:

$$export\_share_i = \max(0, export\_share_i^*) \quad (4)$$

We treat both *rel_bank* and *innoprod* as endogenous in equation (2), therefore we will rely on instrumental variables when estimating equations (3) and (4). The set of instruments that we use is presented and discussed in Section 4.4.

3.2 Firm's innovation equation.

The two export equations include innovation among the regressors, since innovation may be a key driver of firm's international activities according to the self-selection hypothesis. We focus, in particular, on product innovation, thus suggesting that the ability to expand into foreign markets crucially depends on the ability to provide products of higher quality or better suited for the export markets (Becker and Egger, 2009; Cassiman et al., 2010; Cassiman and Golovko, 2011).

As we already explained, innovation is itself a risky and costly activity, which may be seriously hindered by financing constraints arising from informational asymmetries between the firm and the bank (Mancusi and Vezzulli, 2014). As such, relationship banking may also improve a firm's ability to introduce innovative products. We thus allow for *rel_bank* to be included among the determinants of firm's innovation output. Since our variable for product innovation (*innoprod*) is binary, we use a Probit model specified as follows:

$$\Pr(innoprod_i = 1) = \Pr(\beta_0 + \beta_1 rel\_bank_i + \beta_2 X_i + \nu_i) \quad (5)$$

where β_0, β_1 and β_2 are the unknown structural parameters to be estimated and ν is an unobservable normally distributed error component.

4. Data and variables

4.1 Data sources

Our main data sources are the 10th UniCredit Corporate Survey (henceforth UCS) on manufacturing firms (formerly known as Capitalia-Mediocredito Centrale Survey), carried out in 2007, and the 1st survey on European Firms in a Global Economy (EFIGE), carried out in 2010. These two surveys gather data concerning, respectively,

the 2004-2006 period and the 2007-2009 period, for a sample of 5137 and 3019 Italian manufacturing enterprises. The sampling design for the firms with less than 500 employees is obtained with a stratification procedure based on firm's size, sector and geographic localization. The surveys collect very detailed information about each firm, such as its ownership and managerial structure, human capital, investment and innovation efforts, internationalization, market strategies, financial management and relationships with banks. This information has been integrated with firm's balance sheet data using the AIDA (Analisi Informatizzata Delle Aziende) database developed and maintained by Bureau van Dijk. Additional information on innovation at NUTS2 (Region) and NUTS3 (Province) levels has been collected using data from the ISTAT (Italian National Statistics Office) national survey on innovation activities, the CRIOS - PATSTAT database on Patent statistics (maintained by the CRIOS Research Center of the Bocconi University), the Statistical Bullettin of the Bank of Italy (SBBI) and the book "Struttura funzionale e territoriale del sistema bancario italiano 1936-1974" (SFT) of the Bank of Italy.

Since the focus of our analysis is on SMEs, out of the original set of 8156 firms we retain all the respondents with less than 250 employees, according to the criterion on the number of employees adopted by the European Commission (2005). Out of this subsample of 7560 SMEs, after cleaning observations with missing data and trimming out the outliers, we end up with a final sample of 4341 SMEs[5]. Table B1 in the Appendix shows that, despite this reduction in the number of observations, our sample is still representative of the population of SMEs in Italy.

4.2 Measurement of relationship banking

The most commonly used proxy for relationship lending in previous empirical works is the duration of a bank–firm relationship (Petersen and Rajan, 1994; Berger and Udell, 1995; Ongena and Smith, 2001; Herrera and Minetti, 2007; Gambini and Zazzaro, 2008; De Bonis et al., 2010). The basic idea is that duration reflects the degree of relationship intensity over time. Alternative measures have been the number of multi-bank relationships or the un-weighted measure of main bank debt concentration (i.e. the share of total bank debts financed by the main bank), both based on the premise that

[5] We should clarify immediately that although we have two consecutive surveys we cannot exploit a panel structure, rather we use a pooled sample in all our regressions.

maintaining an exclusive bank relationship promotes the development of close ties between bank and borrower (Elsas, 2005).

Evidence on the significance of such indicators on firm's performance in terms of innovation, export and growth has been rather mixed. We therefore try to complement this literature and proxy the strength of relationship lending with the share of firm's total assets that are financed through the main bank. Our indicator is computed as:

$$\text{rel\_bank} = \text{quota\_bank} \times \frac{bank\_debts}{total\_assets} \times 100 \qquad (6)$$

where *quota_bank* is the share of the firm's total bank debts (*bank_debts*) financed through the main bank and *total_assets* is the book value of firm's total assets. The share of the firm's total bank debts financed through the main bank is obtained from a question that refers to the last year of the survey period. It is then multiplied by the ratio of total bank debts over total assets, in order to quantify the share firm's total assets that are financed through loans by the main bank.

We argue that this indicator (*rel_bank*) is a good proxy for the strength of relationship banking, particularly for SMEs. In Appendix A we report a principal component analysis on a sub-sample of SMEs for which we have additional information to show that our measure better correlates with the definition of relationship banking proposed by Boot (2000), compared to the duration (in years) of the bank-firm relationship (*nyears_bank*) and the number of multi-bank relationships the firm holds (*n_banks*). Moreover, our measure also has theoretical appeal since it is closely related to the concept of "bank debt concentration" (Berger and Udell, 1995), which has been argued to be an effective strategy, pursued especially by SMEs, in order to overcome information asymmetries. On the one hand, since bank debt financing usually involves an accurate ex-ante screening, a high bank debt concentration can be used by the firm as a signal of "low risk profile" in order to attract other investors (Smith, 1987). On the other hand, a higher bank debt concentration may translate in larger economies of scale in information production for the main lending bank, which can thus put more effort in monitoring activities in order to prevent moral hazard problems (Diamond, 1984).

The monitoring role of banks is consistent with the theory of "trade-off", which suggests that in less liquid markets banks have greater corporate involvement, although not necessarily through equity holdings (Bolton and Von Thadden, 1998). Dispersed debt holders may face the same free-rider problem as dispersed equity holders when it comes to monitoring management, whereas concentrated debt ensures that the debt holder will find it worthwhile to better monitor the firm and the information produced from this monitoring effort allows to block an inefficient move by the managers of the firm (Kroszenr and Straham, 2001).

Many empirical works support these hypotheses, showing that bank debt concentration tends to be associated with a larger amount of overall credit availability (Petersen and Rajan, 1994; Ghosh, 2006). Moreover bank "control" of firm's assets is important to explain differences in the accounting performance measures of returns on investments (Krivogorosky et al., 2009), consistently with Von Thadden (1995) "one-creditor model" of the firm-bank relationship.

4.3 Export and innovation

Our empirical model aims at explaining both the extensive and the intensive margin of export, hence our main variables of interest concern the firm's exporting activities: *export*, i.e. a dummy variable equal to 1 if the firm sells at least part of its production abroad in the last year of the survey's reference period, and *export_share,* which is the self-reported percentage of firm's export on total sales. Both variables are obtained from the UCS and EFIGE surveys.

A further key variable involved in our analysis is innovation. As already discussed, we focus on product innovation and use a dummy variable (*innoprod*) that is equal to 1 if the firm reports to have introduced at least one innovative product during the survey reference period, hence in the three years preceding the survey collection. The definition of product innovation provided by the survey's questionnaire is similar with the one adopted by the Community Innovation Survey (CIS), which follows the guidelines of the Oslo Manual. In order to drop marginal innovations, we code the dummy variable *innoprod* as being equal to 0 if, over the same period, either the firm didn't introduce any product innovations or the average percentage of firm's turnover from innovative product sales (also available from the survey) was less than 10%.

4.4 Instrumental variables

Our indicator of relationship banking is likely to be endogenous, leading to inconsistent estimates of the structural parameters, in all the equations (3), (4) and (5).

This is because relationship banking can be jointly determined with the firm's innovation and export strategies (e.g. a firm could choose the bank and the intensity of their relationship according to its innovation and exporting strategies) and also because of potential omitted variable bias. To test the exogeneity of our relationship banking regressor, and to get consistent estimates in case of endogeneity, we rely on instrumental variable (IV) methods using the same set of instruments (Z) proposed by Guiso et al. (2004) and Herrera and Minetti (2007), which aim to identify exogenous shocks on the local supply of banking services that are unlikely to affect directly firm's innovation and export decisions.

The set of potential instrumental variables include *nbranches_p*, i.e. the number of bank branches per 1,000 inhabitants in 1936 in the province where the firm is located, and *new_branch_inc*, which is the average number of new branches created by incumbent banks per 1,000 inhabitants computed over the period 1991-2004 in the province where the firm is located.

The choice of this set of instruments is justified by the fact that in 1936 the local supply of banking services was strictly regulated by the Italian central government, which constrained each credit institution to open new branches only in the local geographical area of competence. This regulation had variable degree of tightness, depending on the local number of saving banks and cooperative banks, and affected the level of local banking supply and competition until the deregulation reform in the late 1980s. Thus, the local degree of tightness of this regulation is reflected by both the bank's market structure in 1936 and the degree to which the following deregulation impacted on the local supply of new branches. However it is difficult to predict the way our instruments could affect the strength of credit relationships. In fact, "… less tightly regulated provinces allegedly experienced a greater inflow of branches until the second half of the 1980s but also a lower one in the adjustment period following the deregulation…"[6].

[6] Herrera and Minetti (2007). See also Guiso et al. (2004) for a more detailed discussion on the selected instrumental variables.

We further have to deal with the potential endogeneity of *innoprod* in the export equations (3) and (4). We therefore use an additional instrumental variable (*bcit_ITA*), which is a proxy for the intensity of localized incoming knowledge spillovers. It is defined as the total number of backward citations (excluding self citations) per 1,000 inhabitants from the patents filed at the European Patent Office (EPO) from 1990 until 2004 (considering the priority filing date) by applicants located in the same province (defined using the Eurostat NUTS3 codes) and active in the same economic sector of the focal firm[7]. The patent citation count is then normalized by the NUTS3 province population in 2004.

Citations are references to previous patents included into patent documents and, since the seminal contribution of Jaffe et al. (1993), can be taken as a paper trail of knowledge flows: a reference to a previous patent indicates that the knowledge of that patent was in some way useful for developing the new knowledge encompassed in the citing patent. In order to avoid considering knowledge flows directly coming from abroad (which can potentially be related to export activities), we consider only citations to national patents (i.e., patents filed by Italian applicants).

This variable is likely to affect firm's propensity to innovate, since a vast literature has shown that localized knowledge spillovers are an important input in the knowledge production function (Breschi and Lissoni, 2001; Mancusi, 2008). Furthermore, related to our setting, localized knowledge spillovers have also largely been associated with the working of the Italian industrial districts (Munari et al., 2012). By contrast, since we focus on incoming spillovers from other Italian innovators, our variable is unlikely to be directly related to the firm's simultaneous export strategies.

4.5 Control variables

Our control variables include several firms' individual characteristics that are likely to affect both the firm's innovation propensity and its export strategy. Most of these control variables are taken from the recent existing literature (Herrera and Minetti, 2007; De Bonis et al., 2010; Minetti and Zhu, 2011) and include a set of firm's financial variables computed in years 2004 and 2007 (i.e. the starting year of the UCS and EFIGE survey reference periods). These include the variable *ltot_assets* (logarithm of total assets

[7] This variable has been computed using patent citations data coming from the CRIOS-PATSTAT database. The concordance between the technological classes of each citing patent and the NACE 2 digits sector of the focal firm has been performed using the International Patent Classification (IPC) codes proposed by the Institut National de la Propriété Industrielle (INPI) and the Observatoire des Sciences et des Techniques (OST) and described by Hinze et al. (1997).

in Euro), *debts (*Total debts/Total Assets) and *cash_flow (*Cash Flow / Total Assets.). The first variable, i.e. the logarithm of total assets, is used as a proxy for firm's size. Firm's liquidity (*cash_flow*) and firm's leverage (*debts*) are then adopted to control for the probability that the firm may be subject to credit constraints (Minetti and Zhu, 2011).

In our specification we also include the logarithm of age (*age*), which allows to control for firm's experience and can be considered as an important predictor for firm's performance and probability of default. Moreover, we include a dummy for young firms (*young*), which equals 1 if the firm has been founded after 1998. This is included because young firms typically face additional problems because of their informational opaqueness. By contrast, being part of a group can benefit the firm through mutual financial assistance, knowledge spillovers and distribution network cost sharing. In order to control for such effects, we therefore include a dummy variable *group*, which equals 1 if the firm belongs to a group.

Together with the individual variables described above, we then have a set of geographical dummies that identify three macro-areas: *north-east*, *centre* and *south* (*north-west* is left out as the reference category), codified according to the NUTS1 classification proposed by Eurostat. These dummies are typically used in empirical analyses on national Italian data and are aimed at capturing different levels of economic and infrastructure development and distances to various foreign target markets (EU, North East Europe, South East Europe, North Africa, etc.). A set of dummy variables for each NACE 2 digits level macro sector is also included to account for sector specificities.

Finally, in order to better control for the local level of economic and banking development, we also use the following variables:

- *vat_popres*: the value added (millions of Euros) per 1,000 inhabitants of the province where the firm is located in 2004;
- *branch_04*: the average number of bank branches per 1,000 inhabitants of the province where the firm is located for the period 1991-2004;
- *HHI:* the average Herfindhal Hirschman index of bank deposits concentration of the province where the firm is located for the period 1991-2004.

Table 1 provides definitions and sources for all the variables involved in the analysis, while Table 2 reports the main descriptive statistics. A pair-wise correlation matrix for all these variables is reported in Appendix B.

--- Insert Table 1 about here ---

--- Insert Table 2 about here ---

5. Results

5.1 Determinants of innovation

As already discussed, our indicator *rel_bank* may be endogenous with respect to firm's innovation strategies. We thus estimate equation (5) with Two-Stage Least Squares (2SLS) methods using the set of instrumental variables described in section 4.4 (namely *nbranches_p* and *new_branch_inc*). The relevancy of the selected instrumental variables is confirmed by the rejection of both the F-statistic and the Kleibergen-Paap statistic. The Hansen J test statistic confirmed the validity of our chosen set of instruments, whereas both the Hausman test and the C-statistic test do not reject the exogeneity of *rel_bank*.[8] We thus decide to treat our measures *rel_bank* as exogenous and estimate equation (5) with heteroskedastic Maximum Likelihood Probit method. This would result in more efficient estimates with respect to 2SLS ones.

Results for the innovation equation (5) are shown in Table 3, which reports the estimated coefficients and the Average Marginal Effects (AMEs), along with their standard errors (in parenthesis).

--- Insert Table 3 about here ---

Our indicator *rel_bank* has a positive and statistically significant impact on product innovation propensity. The estimated average marginal effects in terms of increased predicted probability of introducing an innovative product is about +3.08% for one point increase of *rel_bank* (i.e., one standard deviation increase of the original measure, since we are considering its standardized version in all the estimated models). Therefore, we find a significant and economically sizeable effect of the strength of relationship lending on product innovation, in line with Herrera and Minetti (2007). Concerning the other determinants of innovation, we find that larger firms tend to be more innovative and, consistently with Munari et al. (2012), that firms located in provinces with high intensity of knowledge flows from other Italian innovators (*bcit_ITA)* have a higher propensity to innovate.

[8] In particular, when estimating model (5) with 2SLS methods, the resulting Sargan over-identification statistic is 0.074 (p-val 0.4950), the Anderson LM under-identification statistic is 4.346 (p-val 0.114), the C endogeneity test statistic is 0.466 (p-val 0.4950).

5.2 Determinants of exporting

Table 4 shows the regression estimates for the extensive margin of exports (equation (3)). Both *rel_bank* and *innoprod* are treated as endogenous and the instruments *nbranches_p*, *new_branch_inc* and *bcit_ITA* are used to identify their effect. In column (1) we report the estimates using the efficient Full Information Maximum Likelihood (FIML) estimation technique proposed by Amemiya (1978) and improved by Newey (1987), along with the associated fist-step estimates in columns (2) and (3). Both *rel_bank* and *innoprod* are positive and statistically significant in the firm's export decision equation. The estimated marginal effects for the efficient FIML IV Probit model are 0.2474 for *rel_bank* and 0.6130 for *innoprod*. That is, a unit increase of *rel_bank* increases the predicted probability of exporting (extensive margin) by about 24.74%, whereas the introduction of a new innovative product increases the predicted probability of exporting by about 61%.

Column (4) reports estimated coefficient from a GMM-IV Linear Probability Model (LMP): the Hansen J test statistic confirms the validity of our chosen set of instruments and both the Hausman test and the C-statistic test reject the exogeneity of *rel_bank* and *innoprod*.[9]

--- Insert Table 4 about here ---

We finally analyze the determinants of the intensive margin of exports, measured by the percentage of total revenues from exported sales (*export_share*). Since this dependent variable is bounded by construction between 0 and 100, we estimate equation (4) with a Full Information Maximum Likelihood (FIML-IV) Tobit model (Amemiya, 1979; Newey, 1987). The estimated coefficients and standard errors are reported in Table 5 column (3), along with the first-step estimates in columns (1) and (2).

--- Insert Table 5 about here ---

[9] In particular, when estimating model (3) with 2SLS methods, the resulting Sargan over-identification statistic is 1.239 (p-val 0.2657), the Anderson LM under-identification statistic is 7.358 (p-val 0.0613), the C endogeneity test statistic is 4.137 (p-val 0.0420).

In this final model we use the same set of endogenous regressors, exogenous variables and instruments as in the previous Probit IV model. The estimated marginal effects on the intensive margin are 2.98 for *rel_bank* and 11.74 for *innoprod*. These findings confirm that the magnitude of the estimated marginal effect of *rel_bank* on firm's export is smaller than the one of *innoprod*, but still not negligible.

In order to better qualify the marginal effect of *rel_bank* and *innoprod* on both the extensive and the intensive margins of exports, we can compute the decomposition proposed by McDonald and Moffit (1980). The decomposition can be written as:

$$\frac{\partial E(export_{share}{}^{*}|x)}{\partial x} = \frac{\partial Pr(export\_share^{*}>0|x)}{\partial x} E(export\_share^{*}|export\_share^{*} > 0, x) + Pr(export\_share^{*} > 0|x) \frac{\partial E(export\_share^{*}|export\_share^{*}>0,x)}{\partial x} \quad (7)$$

where the first component is the expected percentage increase of *export_share* due to the positive marginal effect of x on the probability of exporting for domestic firms, whereas the second component is the expected percentage increase of *export_share* due to the positive marginal effect of x on the export intensity for already exporting firms.

Given that the estimated conditional probability of exporting Pr(*export_share**>0|x) is about 0.5447 and the estimated conditional export intensity E(*export_share**>0| *export_share**>0,x) is about 48.31, the two addends of the Mc-Donald and Moffit decomposition for *rel_bank* are 9.39 and 1.66, whereas for *innoprod* they are 31.73 and 6.39. Thus, for an already exporting firm a one unit increase in *rel_bank* has an estimated impact of about +1.66% on the intensive margin, whereas the introduction of a new innovative product affects export intensity by about +6.39%.

We can now disentangle the estimated effect of an increase in the strength of the banking relationship into the direct impact on the probability and intensity of exporting and the indirect impact that goes through the increased propensity to introduce an innovative product.

For the export decision (the extensive margin), the estimated direct effect of an unit increase in *rel_bank* is 0.247 in terms of increased probability of exporting, whereas the estimated indirect effect is 0.613*0.0308=0.019 (where 0.0308 is the estimated AME of *rel_bank* in the product innovation equation reported in Section 5.1). As for the percentage of export on total sales (intensive margin) the estimated direct effect for one unit increase in *rel_bank* is +2.98%, whereas the estimated indirect effect is 11.74

*0.0308=0.36%. Thus the estimated direct effect of *rel_bank* on firm's exports seems to be larger than the indirect one, when considering both the extensive and the intensive margins.

These results suggest that the strength of the firm-bank informational ties has a non-negligible benefit on both export participation and export intensity. This effect is mostly direct and independent from the innovation activity of the SMEs, because informational tightness seems to boost SMEs' innovation output only to a mild extent.

5.3 Exploring the bank lending and the non-financial services channels.

In the previous section we found that the strength of the firm-bank informational ties positively affects SMEs export both directly and indirectly (through the promotion of product innovation), although the first effect is significantly stronger than the latter. As discussed in section 4.2, one explanation for this effect is the "bank-lending channel", which is triggered by borrowing concentration, as a way to mitigate informational asymmetries and to encourage banks in investing in soft information.

In this section we provide further empirical support to this "bank lending channel" assumption, by analyzing how our indicator of relationship banking correlates with the firm's probability of being credit constrained and of having access to particular form of export-financing loans.

In order to identify credit-constrained firms, we rely on two variables based on specific questions included in both the UCS and the EFIGE surveys. The first one, *morecredit*, is a dummy variable equal to 1 if the firm was willing to increase its borrowing at the same interest rate of its current credit line in the last year of the survey period (2005 and 2009, respectively). The second dummy variable, *rationed* is observed only for the subset of firms with *morecredit* = 1 and is itself equal to 1 if in the same year the firm looking for more credit did indeed apply for it and was denied it.[10] The number of firms answering positively to the first question is 774 (17.83%).[11] Among these, 249 firms (32.17%) declare having applied for more credit and being denied (*rationed*=1). We then assess how the indicator of relationship banking affects the probability of being credit constrained by estimating the following bivariate probit model with selection (Van de Ven and Van Pragg, 1981; Piga and Atzeni, 2007):

[10] We also adopted a broader definition of *rationed* by including also those firms that were willing to pay a higher interest rate in order to increase their borrowing. Results are very similar to the ones we present in this section and are available upon requests.
[11] 73 responses (1.68%) are missing.

$$\begin{cases} \Pr(morecredit_i = 1) = \Pr(\beta_0 + \beta_1 innoprod_i + \beta_2 rel\_bank_i + \beta_3 X_i + u_i > 0) & (8a) \\ \Pr(rationed_i = 1) = \Pr(\gamma_0 + \gamma_2 rel\_bank_i + \gamma_3 X_i + v_i > 0) \quad if\ morecredit_i = 1 & (8b) \end{cases}$$

where X is the same set of control variables used in the previous sections and the error terms u and v are assumed to follow a bivariate standard normal distribution $(u,v) \sim N(0,1)$ with correlation coefficient $\rho = \text{corr}(u,v)$. Results are reported in Table 6 (columns 1 and 2)[12].

--- Insert Table 6 about here ---

We find that relationship banking positively affects the probability that the firm is willing to borrow more (eq. 8a), possibly because the firm judges that bank debt financing is relatively less costly or more likely to be obtained (with respect to other sources of external finance) thanks to the tighter relationship with the main bank, and negatively affects the probability that the request for additional credit is denied (eq. 8b). Concerning the magnitude of this effect we estimate that a one standard deviation increase of *rel_bank* decreases the probability of being rationed by -1.53%. Concerning the effects of the control variables, we find that willingness to increase borrowing is higher for firms with high financial leverage (*debts*) and for firms belonging to a group (*group*). The positive effect of the group dummy here might signal that firms belonging to a group are more likely to offer adequate collateral to the bank and may therefore find bank loans more convenient, thus increasing their incentives to ask for it. As expected, firm's willingness to increase borrowing is lower for firms with larger amount of internal resources (*cash_flow*).

While these results show that relationship banking may indeed act to mitigate credit rationing, the dummy variable that we adopt (*rationed*) is not necessarily related to a shortage of external funds for innovation or export activities. A more specific question asking whether the firm benefited from export finance loans from its main bank is available in the UCS survey for a subset of 835 firms. We thus use this information to

[12] Even though no exclusion restrictions are required to identify the system, we excluded the variable *innoprod* from equation (8b) to increase efficiency. Results are unchanged without this exclusion.

assess whether there is a positive correlation between *rel_bank* and the firm's probability to engage in export finance operations with the main bank (*exp_fin*). Overall, 56 firms benefited from export finance loans (*exp_fin=1*) while 779 firms did not (*exp_fin=0*). The mean value of *rel_bank* is higher in the former group than in the second one (3.22 vs. 1.96) and the difference is statistically significant at the 1% level. We also estimated a probit regression using *exp_fin* as dependent variable, *rel_bank* and *innoprod* as independent variables together with the set of control variables in *X* to control for potential confounding factors affecting such difference.[13] Estimation results are reported in column (3) of Table 6. The coefficient of *rel_bank* is positive and statistically significant, with an estimated marginal effect of +3.04% on the firm's probability of being involved in export finance operations with its main bank. We further find that the probability benefiting from export finance operations increases with firm's innovation and size (*ltot_assets*): large and innovative firms are indeed more likely to export and to be in need of sophisticated and targeted baking services. By contrast, the probability benefiting from export finance operations decreases with the concentration degree of the bank deposits in the province (*HHI*).

All in all, our findings suggest that relationship lending increases both export propensity and intensity and that this effect can be explained by the "bank lending channel" hypothesis, i.e. by its role in mitigating credit constraints for the firm.

Alternative hypotheses have been proposed and tested in the literature regarding non-financial services that banks can provide to support firm's export. These include, for example, intermediation activities in foreign markets for facilitating the firm's matching with local suppliers, partners and costumers. Banks can also act as gateway of information spillovers arising from its portfolio of exporting client firms (Inui et al. 2013) or from the presence of own subsidiaries in the target foreign market (Bronzini and D'Ignazio, 2012). Such knowledge flows allow firms to reduce the start-up costs associated to export and are particularly useful for SMEs. In this regard, large banks can offer a wider set of non-financial services designed to support SMEs willing to enter a foreign market with respect to small and local banks.

In order to have an empirical assessment of these alternative channels, we used a question included in the UCS survey asking the firm to classify its main bank, choosing between (i) large national bank, (ii) savings bank, (iii) cooperative bank, (iv) people's

[13] Note however that, due to data limitations, we cannot deal with sample selection and endogeneity issues in order to assess whether a stronger relationship with the main bank has a causal effect on the firm's probability of having access to this type of loans.

bank, (v) international bank. Out of the 2683 of respondents, 2151 firms indicated that their main bank is a small and local one (options (ii), (iii) and (iv)), whereas 532 firms indicated a large national or international bank (options (i) and (v), respectively).

We thus re-estimated the export equations (3) and (4) separately for these two sub-samples, finding a stronger positive effect of *rel_bank* on both the intensive and extensive margins of export in the subsample of firms with a large main bank. In particular, concerning the extensive margin (equation 3), the estimated marginal effect of *rel_bank* is 0.889, in the sub-sample of firms with a large or internationalized main bank, whereas the corresponding value is 0.237 in the sub-sample of firms with a small local bank. Concerning the intensive margin of export (equation 4), the estimated marginal effect of *rel_bank* is 2.99 in the sub-sample of firms with a small local main bank, whereas it is 12.54 in the sub-sample of firms with a large or internationalized main bank. We thus observe that the positive direct effect of *rel_bank* on both the export margins is stronger when the main bank is large or internationalized.

This evidence is in line with the fact that large banks provide more effective services for supporting firm's export activities with respect to small local banks, which are also subject to special regulations, including stronger limitations in terms of size and scope of their lending activity and geographical reach (Del Prete and Federico, 2014).

6. Conclusions

The intensity of bank-firm relationships can be a valuable instrument for the reduction of informational asymmetries, which inevitably condition investor-investee relations, and can thus help small businesses seeking external resources to finance their innovation and internationalization activities. In fact, a strong bank-firm relationship may allow the former to acquire non-codified ("soft") information about the actual degree of solvency of the latter (thus reducing adverse selection problems)and to exert a more effective control on the degree of the SMEs "due diligence" in the management of ordinary activities as well as of innovation and internationalization projects (thus reducing moral hazard problems).

The present study adds new insights on the impact of the strength of credit ties between banks and SMEs when these face both the choice to innovate and to export. We extend and improve existing evidence in three ways. First, our econometric model analyzes the effect of relationship banking on firm's innovativeness and access to foreign

markets in a comprehensive framework, by taking into account the simultaneous feedbacks between innovation and export activities. Second, by so doing, we are able to disentangle the direct benefits of relationship banking on SMEs' exporting decision (extensive margin) and share of export on total sales (intensive margin) from the indirect benefits exerted through the promotion of product innovation. Third, we adopt a measure of informational tightness, based on the firm's amount of credit with the main bank divided by its total asset, which takes into account the extent of firm's access to external finance, the exclusivity of the relationship with the main bank and the degree of informal control that the latter can exert through debt concentration.

Estimation results from our econometric model suggest that the strength of the firm-bank informational ties has a non-negligible benefit on both the export participation decision and the intensity of export. We also find that this effect is mostly direct and independent from the innovation activity of the SMEs, because informational tightness seems to boost SMEs' innovation output only to a mild extent. We further explore the potential channels through which the positive effects of relationship banking on the two export margins realize. Although constrained by data availability, our analysis suggests that processes based on both financial (e.g. lending) and non-financial channels are at work. Further research should better investigate such processes, examining for instance how effectively banks complement financial support to SMEs foreign operations with other services. These have recently become particularly important, since a number of banks have developed export-related services for small firms, such as the provision of reliable and broad information on foreign markets, facilitated contacts with institutions and authorities abroad, dedicated advice on investment strategies beyond the national borders, assessment of the mutual reliability of the parties.

Despite these opportunities for further improvements, we believe that our findings are helpful to better understand the relevance of firm-bank relationship as an important driving force in the process of growth and internationalization of SMEs, with a particular emphasis on the innovation, which plays a crucial role in the exporting decision and size and which is also the most problematic one in terms of market imperfections for external financing. Our results suggest that the bank is more than a pure liquidity provider: it can also help in mitigating the credit constraints and lack of other non-financial services that a firm could eventually face once it decides to expand abroad. Inefficiencies in the bank-firm relationship could therefore have more profound consequences than those proxied by credit constraints.

Table 1: Variables description		
Variables	**Description**	**Source**
rel_bank	Percentage of firm's main bank loans on Total Assets (standardized).	AIDA-UCS-EFIGE
innoprod	Dummy = 1 if the firm introduced an innovative product	
export	Dummy = 1 if the exported	UCS-EFIGE
export_share	Percentage of firm's export over Total Sales	
ltot_assets	Logarithm of Total Assets	
debts	Total Debts on Total Assets	AIDA
cash_flow	Cash Flow on Total Assets	
age	Logarithm of form's age in years	
young	Dummy = 1 if the firm is less than 10 years old	
group	Dummy = 1 if the firm belongs to a group	UCS-EFIGE
north_east	Dummy = 1 if the firm is located in the North-East	
centre	Dummy = 1 if the firm is located in the Centre	
south	Dummy = 1 if the firm is located in the South	
vvat_popres	Value added (in millions of Euro per 1000 inhabitants) in 2004 at the province (NUTS3) level	ISTAT
branch_04	Average number of bank branches per 1000 inhabitants in the period 1991-2004 at the province (NUTS3) level	
HHI	Average Herfindhal Hirschman Index of bank deposits concentration during the period 1991-2004, at the province (NUTS3) level	SBBI
nbranches_p	Number of bank branches per 1000 inhabitants in 1936, at the province (NUTS3) level	SFT
new_branch_inc	Average number of new branches created by incumbent banks per 1000 inhabitants in 1991-2004, at the province (NUTS3) level	SBBI
bcit_ITA	Number of backward patent citations (excluding self citations) per 1000 inhabitants from citing patents filed during the period 1990-2004 by applicants from the same province (NUTS3) and industry (NACE 2 digits) and citing other national patents.	CRIOS-PATSTAT

Table 2: Main descriptive statistics (N=4341)				
Variables	**Mean**	**St. Dev**	**Min**	**Max**
rel_bank	9.204	14.282	0	100
rel_bank (standardized)	-0.002	1.002	-0.648	6.366
innoprod	0.661	0.473	0	1
export	0.655	0.475	0	1
*export_share**	24.712	29.202	0	100
ltot_assets	12.657	3.631	3.040	19.102
debts	0.679	0.225	0.006	6.292
cash_flow	0.056	0.060	-0.250	0.304
age	3.148	0.718	0	5.553
young	0.113	0.317	0	1
group	0.155	0.362	0	1
north_east	0.294	0.456	0	1
centre	0.185	0.389	0	1
south	0.125	0.330	0	1
vvat_popres	24.292	4.867	11.242	33.388
branch_04	0.524	0.127	0.210	0.976
HHI	0.099	0.048	0.036	0.425
nbranches_p	0.208	0.079	0.037	0.618
new_branch_inc	0.021	0.009	0.002	0.045
bcit_ITA	0.070	0.148	0	1.020

* *export_share* is available for 4276 observations in the final sample (65 observations are missing).

Table 3: Determinants of innovation

	Coefficients	**Marginal Effects (AMEs)**
Variables	***innoprod***	***innoprod***
rel_bank	0.0869***	0.0308***
	(0.0289)	(0.0102)
ltot_assets	0.0434**	0.0154**
	(0.0201)	(0.0071)
debts	0.0379	0.0134
	(0.107)	(0.038)
cash_flow	-0.347	-0.123
	(0.377)	(0.133)
age	-0.0013	-0.0005
	(0.0411)	(0.0146)
young	0.0561	0.0197
	(0.0889)	(0.0308)
group	-0.0686	-0.0246
	(0.0603)	(0.0218)
vvat_popres	0.0118	0.0042
	(0.0075)	(0.0027)
branch_04	-0.228	-0.0809
	(0.241)	(0.0855)
HHI	0.0984	0.0349
	(0.497)	(0.176)
bcit_ITA	0.608**	0.215**
	(0.255)	(0.0902)
Constant	0.528	
	(0.332)	
Observations	4,341	4,341

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dummies for years 2004-2006, NACE 2 digits sector and NUTS1 macro-area included

Table 4. Determinants of the probability of export

	(1)	(2)	(3)	(4)
Estimation method	**FIML-IV Probit**	**FIML-IV Probit**	**FIML-IV Probit**	**GMM-IV LPM**
Variables	***export***	***innoprod***	***rel_bank***	***export***
innoprod	1.954***			1.541*
	(0.025)			(0.805)
rel_bank	0.347***			0.556
	(0.0203)			(0.526)
ltot_assets	0.098***	0.0153**	-0.053***	0.137
	(0.017)	(0.0069)	(0.012)	(0.0937)
debts	-0.330***	0.0241	0.752***	-0.487
	(0.099)	(0.0432)	(0.105)	(0.414)
cash_flow	0.001	-0.130	-0.314	0.834
	(0.383)	(0.159)	(0.248)	(0.715)
age	0.0382	0.00035	0.0074	0.0137
	(0.029)	(0.0115)	(0.025)	(0.0478)
young	-0.0306	0.0208	-0.0016	-0.0315
	(0.0701)	(0.0304)	(0.0617)	(0.0672)
group	0.0921*	-0.0256	-0.096***	0.0602
	(0.0495)	(0.0204)	(0.031)	(0.0438)
vvat_popres	-0.0069	0.0042*	-0.0006	-0.0049
	(0.0053)	(0.0021)	(0.0046)	(0.0066)
branch_04	0.211	-0.0120	-0.190	4.413
	(0.164)	(0.0815)	(0.202)	(25.39)
HHI	-0.146	0.0573	0.425	-0.0998
	(0.337)	(0.127)	(0.312)	(0.392)
nbranches_p		-0.139**	0.366*	
		(0.0648)	(0.205)	
new_branch_inc		0.256	4.408*	
		(0.757)	(2.462)	
bcit_ITA		0.170***	-0.062	
		(0.039)	(0.120)	
Constant	-2.278***	0.653***	0.427*	-1.451
	(0.245)	(0.101)	(0.224)	(1.177)
Observations	4,341	4,341	4,341	4,341

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dummies for years 2004-2006, NACE 2 digits sector and NUTS1 macro-area included

Table 5: Determinants of the intensity of export

	(1)	(2)	(3)
Estimation method	**FIML-IV Tobit**	**FIML-IV Tobit**	**FIML-IV Tobit**
Variables	***rel_bank***	***innoprod***	***export_share****
innoprod			239.6***
			(3.230)
rel_bank			27.69***
			(1.764)
ltot_assets	-0.052***	0.016***	6.313***
	(0.012)	(0.006)	(1.641)
debts	0.751***	0.021	-29.93***
	(0.107)	(0.031)	(9.356)
cash_flow	-0.361	-0.147	4.057
	(0.244)	(0.137)	(37.61)
age	0.014	0.0006	1.844
	(0.025)	(0.0131)	(3.456)
young	0.006	0.0196	-3.407
	(0.062)	(0.0286)	(7.494)
group	-0.106***	-0.0204	9.784*
	(0.031)	(0.0184)	(5.005)
vvat_popres	0.0005	0.0047*	-1.325**
	(0.0047)	(0.0024)	(0.639)
branch_04	-0.210	-0.0383	21.61
	(0.206)	(0.0778)	(18.24)
HHI	0.502	0.0667	-13.60
	(0.323)	(0.188)	(48.04)
nbranches_p	0.449**	-0.0753	
	(0.209)	(0.0494)	
new_branch_inc	3.986	-0.220	
	(2.542)	(0.566)	
bcit_ITA	-0.014	0.191***	
	(0.130)	(0.0306)	
Constant	0.449**	-0.075	-223.3**
	(0.209)	(0.049)	(27.97)
Observations	4,276	4,276	4,276

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dummies for years 2004-2006, NACE 2 digits sector and NUTS1 macro-area included
* *export_share* is available for 4276 observations in the final sample (65 observations are missing).

Table 6: Relationship banking and access to credit.

	(1)	(2)	(3)
Estimation method	**Bivariate Probit with Selection**		**Probit**
Variables	***morecredit***	***rationed***	***exp_fin***
innoprod	0.0101		0.285**
	(0.0569)		(0.142)
rel_bank	0.101***	-0.0687*	0.517*
	(0.0252)	(0.0376)	(0.293)
ltot_assets	0.0112	0.00063	0.173***
	(0.0274)	(0.0369)	(0.0614)
debts	0.866***	0.206	-0.0604
	(0.168)	(0.200)	(0.399)
cash_flow	-3.082***	0.486	-0.263
	(0.507)	(1.187)	(1.094)
age	-0.0217	0.0184	-0.0493
	(0.0514)	(0.0732)	(0.135)
young	0.126	-0.128	-0.0975
	(0.107)	(0.145)	(0.297)
group	0.173**	0.126	-0.134
	(0.0758)	(0.117)	(0.176)
vvat_popres	0.00569	0.00882	0.0114
	(0.0090)	(0.0133)	(0.0252)
branch_04	-0.107	-0.463	-0.607
	(0.316)	(0.462)	(0.726)
HHI	-0.0953	0.164	-3.329*
	(0.611)	(0.854)	(1.763)
Constant	-1.078**	0.220	-3.670***
	(0.445)	(0.611)	(1.370)
rho	-0. 8567** (0.1399)		
Wald test of indep. eqns. (rho = 0)	5.93 p-val(0.0149)		
Observations	4,268	774	835

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dummies for years 2004-2006, NACE 2 digits sector and NUTS1 macro-area included

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Appendix A: principal component analysis.

In this section we perform a principal component analysis in order to check if our variable *rel_bank* can be considered as a good proxy for the concept of "relationship banking". First of all, we define what we precisely mean with "relationship banking".

According to Boot (2000), relationship banking is the provision of financial services by a financial intermediary that:

i. invests in obtaining customer-specific information, often proprietary in nature and

ii. evaluates the profitability of these investments through multiple interactions with the same customer over time and/or across products.

This definition is thus centered around two critical dimensions: exchange of proprietary "soft" information and multiple interactions. We can retrieve some information on the importance of these factors by focusing on a subsample of about 1,000 firms who responded to some specific questions included in the UCS survey.

The questionnaire asked the firms to state the importance of the following factors affecting the choice of the main bank (using a Likert scale that ranges from 1=very important to 4 = not important):

1) The bank knows well the firm's main business
2) The bank knows some of the firm's managers or owners
3) The bank knows well the firm's industry
4) The bank knows the firm's local economy
5) The bank knows the firm's market conditions
6) High frequency of meetings or other contacts between the firm and the bank's local branch manager
7) The bank takes quick decisions
8) The bank provides multiple services
9) The bank provides a wide international network
10) The bank provides efficient Internet-based services
11) The bank provides stable credit lines
12) The cost of the bank loans and services is affordable
13) The bank's loan conditions are simple and clear
14) The bank is strategically well located.

We then define 14 dummy variables (dum1-dum14), one for each question, which are codified with 1 when the firms' answer is "1=very important" and 0 otherwise. By performing a Principal Component Analysis on this set of 14 dummies, we extract and rotate (using Varimax method) the first two common factors (Factor1 and Factor2) that account for the 54.72% of the overall variance and show the factor scores reported in Table A1.

Table A1: Factor scores estimation

Variable	**Factor1**	**Factor2**	**Uniqueness**
dum1		0.7163	0.4713
dum2		0.7879	0.3755
dum3		0.7296	0.3843
dum4		0.7031	0.4515
dum5		0.6125	0.4798
dum6		0.4640	0.6081
dum7	0.6678		0.4916
dum8	0.7875		0.3486
dum9	0.6710		0.4932
dum10	0.6488		0.5235
dum11	0.7338		0.4424
dum12	0.7794		0.3612
dum13	0.7493		0.4203
dum14	0.6529		0.4884

(blanks represent abs(loading)<.45)

Table A1 suggests that Factor1 identifies characteristics of the firm-bank relationship based on questions 7-14, whereas the second factor identifies characteristics that are more related with the set of the first six questions, which are very close to the adopted definition of "relationship banking" (importance of customer-specific information, multiple interactions with the same customer over time, …).

We then analyze the degree of correlation between Factor2 and our proxy variable (*rel_bank*) and compared it with two alternative measures widely used in the literature of relationship banking: the duration of the relationship (number of years) with the main bank (*nyears_bank*) and the number of bank relationships the firm maintains (*n_banks*). We find that Factor2 shows the strongest degree of pair-wise correlation with our relationship banking indicator, *rel_bank* (0.1009), followed by *nyears_bank* (0.0268) and by *n_banks* (0.0422).

As a final robustness check we also re-estimated equations (3), (4) and (5) using *nyears_bank* and *n_banks* as alternative measures for relationship banking. We find a positive and significant effect of the duration of the relationship with the main bank on

the firm's propensity to innovate (in line with Herrera and Minetti, 2007), and a non-significant effect on the firm's propensity to export (in line with De Bonis et. al, 2010), whereas the number of banks was never significant in both the innovation and export equations.

Appendix B: further tables.

Table B1 – Firms' distribution by stratification variables

	Survey manufacturing sample (only SMEs)		Final sample	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Size class				
11-20	2,783	36.81	1,535	35.36
21-50	3,052	40.37	1,741	40.11
51-250	1,725	22.82	1,065	24.53
Industry				
Food/Tobacco	621	8.21	352	8.11
Textiles	743	9.83	398	9.17
Leather	277	3.66	158	3.64
Wood	223	2.95	105	2.42
Paper/Print	467	6.18	274	6.31
Chemicals/Coke	328	4.34	180	4.15
Plastic/Rubber	404	5.34	256	5.9
Glass/Ceramics	485	6.42	282	6.5
Metals	1,584	20.95	974	22.44
Machinery/Equipment	1,038	13.73	587	13.52
Electrical/Optical	680	8.99	383	8.82
Vehicles/ Transport	176	2.33	87	2
Furnitures/n.e.c.	534	7.06	305	7.03
Geographical area				
North-West	3,078	40.71	1,721	39.65
North-East	2,237	29.59	1,274	29.35
Centre	1,294	17.12	806	18.57
South	951	12.58	540	12.44
Total	7,560	100	4,341	100

Table B2: Correlation matrix															
	Variable	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
1	*rel_bank*	1														
2	*innoprod*	0.209	1													
3	*export*	0.004	0.042	1												
4	*quota_export*	-0.039	0.033	0.622	1											
5	*ltot_assets*	-0.504	-0.321	0.032	0.109	1										
6	*debts*	0.225	0.043	-0.029	-0.034	-0.109	1									
7	*cash_flow*	-0.101	-0.032	-0.029	-0.036	0.023	-0.379	1								
8	*age*	-0.038	0.016	0.137	0.090	0.059	-0.256	0.024	1							
9	*young*	0.023	-0.003	-0.082	-0.044	-0.028	0.195	-0.028	-0.674	1						
10	*group*	-0.083	-0.017	0.074	0.088	0.138	-0.027	0.021	-0.012	0.042	1					
11	*vvat_popres*	-0.037	0.032	0.135	0.106	0.053	0.008	0.036	0.110	-0.013	0.035	1				
12	*branch_04*	0.019	0.016	0.112	0.092	-0.001	0.031	0.040	0.039	-0.007	0.027	0.511	1			
13	*HHI*	0.043	-0.004	-0.045	-0.019	-0.041	0.003	-0.014	-0.046	-0.005	-0.015	-0.439	-0.120	1		
14	*nbranches_p*	0.044	0.007	0.041	0.051	-0.029	0.025	0.040	0.021	-0.011	0.019	0.188	0.609	0.011	1	
15	*new_branch_inc*	0.011	0.015	0.104	0.065	0.011	0.017	0.044	0.036	-0.020	0.053	0.493	0.720	-0.286	0.219	1
16	*bcit_ITA*	-0.044	0.037	0.089	0.134	0.046	-0.047	0.000	0.034	-0.021	0.065	0.367	0.145	-0.219	0.026	0.186