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THÈSE

Pour obtenir le grade de Docteur en Sciences de Gestion

Présentée et soutenue publiquement par

Jérémie BERTRAND

Le 22 mai 2017

*NATURE ET GESTION DE L'INFORMATION :
IMPACT SUR LE FINANCEMENT RELATIONNEL BANCAIRE*

JURY

Directeur de thèse :

Monsieur Jean-Christophe STATNIK, Professeur de l'Université Lille, Droit et Santé

Membres du jury :

Monsieur Eric DE BODT, Professeur de l'Université Lille, Droit et Santé

Monsieur Christophe GODLEWSKI, Professeur de l'Université Haute-Alsace

Monsieur Frédéric LOBEZ, Professeur de l'Université Lille, Droit et Santé

Monsieur Philippe MADIES, Professeur de l'Université Grenoble Alpes

Madame Catherine REFAIT-ALEXANDRE, Professeur de l'Université de Franche-Comté



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L'Université n'entend donner aucune approbation ni improbation aux opinions émises dans la thèse : ces opinions doivent être considérées comme propres à leur auteur.

« Je voulais être écrivain [...]

Les différentes étapes impliquaient :

a/ de lire beaucoup pour voir ce que les autres écrivains faisaient et ont fait,

b/ d'écrire et d'améliorer mon écriture et

c/ de faire circuler mes écrits – ce qui signifiait prendre des risques

& aller au-delà de la peur du jugement des autres ou d'être ridicule parfois. »

Steve Abbott¹

Il est maintenant temps de prendre des risques.

¹ Fairyland, Alysia Abbott, p. 325

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Chapitre Introductif

1 Contexte

Lauréats du prix Nobel d'économie en 2016, Hart et Holmström, dans leur ouvrage de 1987, développent l'idée que toute relation contractuelle entre un Principal et un Agent est entachée d'asymétrie d'information :

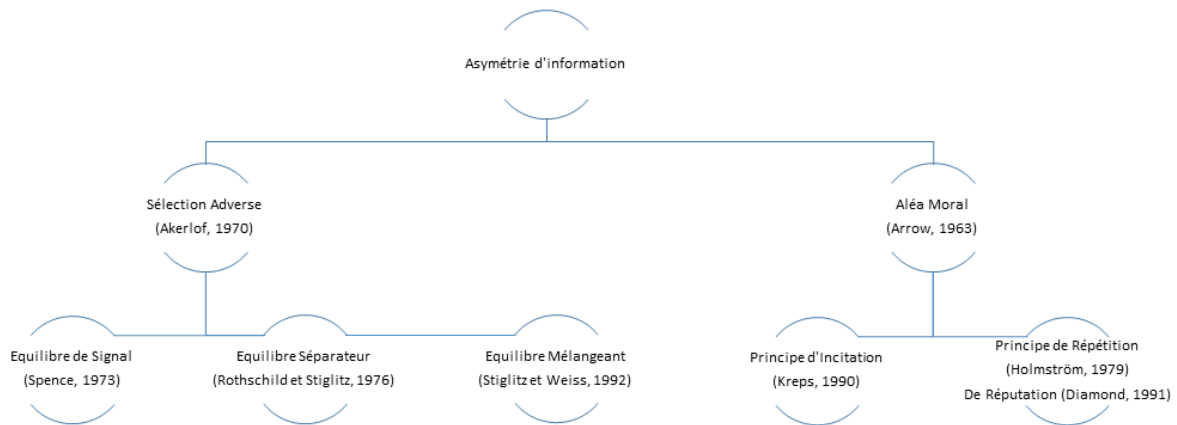
« Chaque modèle d'agence est un problème d'incitation causé par une certaine forme d'asymétrie d'information. »² (Hart et Holmström, 1987).

Cette asymétrie a pour conséquence une incomplétude dans les contrats. Auparavant, les contrats étaient considérés comme complets, et le plus souvent de type contingent : ils spécifiaient l'ensemble des obligations des parties, quelles que soient les différentes situations possibles. Ils permettaient ainsi de parer à toute situation conflictuelle potentielle. Les futurs prix Nobel relèvent cependant, à travers le nombre d'affaires portées en justice, que ces situations existent dans la réalité. Leur explication est que le contrat ne peut être complet du fait des coûts de contractualisation. Dye (1985) explique que « décrire l'état de la nature », c'est-à-dire décrire une situation complète avec l'ensemble de ses possibilités futures, est coûteux, principalement à cause de sa complexité. De plus, cette complexité entraîne une incapacité à vérifier l'ensemble des états possibles. Et sans cette possibilité, le contrat entre le Principal et l'Agent est dépendant de l'information possédée par chacune des parties.

Hart et Holmström (1987) définissent clairement les deux types d'asymétrie d'information existants : l'asymétrie précontractuelle, aussi appelée sélection adverse, et l'asymétrie post-contractuelle, aussi appelée aléa moral. Chacun des deux types peut être résolu par différentes actions présentées dans la figure ci-dessous :

² Hart et Holmström (1987), p.9

Figure 1 : l'asymétrie d'information et ses solutions



Le principe de sélection adverse (cf. figure 1) est un problème où l'asymétrie d'information se situe avant la signature du contrat. Il repose sur le fait que le Principal propose un contrat à un Agent dont il ne connaît pas exactement la qualité.

Akerlof (1970) dans son célèbre article « The Market for “Lemons” » étudie l'impact de la présence d'asymétrie d'information, sur le marché des voitures d'occasion. Dans son modèle, des Agents souhaitent vendre leurs voitures d'occasion, dont la qualité n'est connue que d'eux. Les acheteurs, le Principal, se retrouvent dans une situation de sélection adverse : ils connaissent la qualité moyenne des voitures, mais pas la qualité d'une voiture donnée. Le raisonnement d'Akerlof est le suivant. Pour résoudre le problème d'asymétrie d'information, les acheteurs proposent un prix reflétant la qualité moyenne de l'ensemble des voitures. Mais si ce prix convient aux vendeurs possédant une voiture de qualité moindre, dont le prix réel est inférieur au prix moyen, il ne convient pas à ceux ayant des voitures de qualité. Ces derniers refusent de participer, ne laissant sur le marché que les voitures de mauvaise qualité. La conclusion du modèle est qu'une forte sélection adverse entraîne une situation où les seuls Agents présents sur le marché sont ceux de mauvaise qualité.

Une première solution aux problèmes induits par la sélection adverse est proposée par Spence (1973). L'auteur étudie le marché du travail où un employeur, le Principal, souhaite embaucher des individus, les Agents. Pour Spence, c'est aux Agents informés de se démarquer les uns des autres. Pour cela, ils utilisent un mécanisme de signal. Le signal est une action d'un Agent, connaissant sa qualité, dont le but est d'informer le Principal, ne la connaissant pas. Pour être crédible, tout signal doit répondre à deux critères : son coût doit décroître avec la qualité de

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l'individu, c'est la condition dite de Spence, et il doit être vérifiable, c'est-à-dire que la qualité doit pouvoir être connue avec exactitude plus tard. Dans le cadre de son modèle, Spence montre que le niveau de diplôme de l'Agent représente un signal crédible de la qualité de ce dernier. Ce mécanisme a également été étudié sur le marché des capitaux où l'Agent, l'emprunteur informé, souhaite obtenir un financement du Principal, l'investisseur sous-informé. Ainsi, dans le cadre d'une création d'entreprise, Leland et Pyle (1977) démontrent que la part de capitaux détenus par l'actionnaire peut servir de signal. De même, Zhang et Wiersema (2009) montrent que la firme peut utiliser la certification de ses états financiers par un tiers. Pour Elitzur et Gavius (2003), la présence d'autres investisseurs externes dans la structure de financement de l'entreprise peut aussi jouer un rôle.

Dans cette première solution, c'est l'Agent qui agit dans le but de réduire l'asymétrie existante. Rothschild et Stiglitz (1976) prouvent cependant que l'action peut aussi provenir du Principal. C'est le principe de l'équilibre séparateur. Ils modélisent cela sur le marché de l'assurance. Le Principal, l'assureur, souhaite vendre un contrat d'assurance à des Agents, dont il ne connaît pas la qualité. Afin de connaître cette dernière, le Principal va proposer un éventail de contrats aux Agents. Le but est de les pousser à révéler eux-mêmes leur qualité : on parle d'auto-sélection. Les contrats sont construits de façon à ce qu'à chaque qualité d'Agent, ne correspond qu'un seul contrat répondant à celle-ci. Dans le cadre de l'assurance, les contrats sont construits avec une prime d'assurance négativement corrélée à la franchise du contrat. Ainsi, à l'équilibre, les Agents de faible qualité choisissent des contrats où la prime est élevée mais avec une franchise faible, alors que les Agents de bonne qualité favorisent des contrats à faible prime mais à franchise élevée.

Les équilibres précédents sont des équilibres séparants. Stiglitz et Weiss (1992) démontrent cependant que dans certains cas, une asymétrie résiduelle persiste et ne permet donc pas une séparation complète : c'est l'équilibre de mélange. Cet équilibre est caractérisé par le fait que différents Agents, de différentes qualités, obtiennent le même contrat. Si Spence (1973) est un des premiers à montrer que cet équilibre existe, c'est Stiglitz et Weiss (1992) qui en formalisent les conditions d'apparition : plus l'information détenue par l'Agent est coûteuse à obtenir et plus il y a de probabilité qu'il existe une asymétrie d'information résiduelle, celle-ci entraînant naturellement un équilibre mélangeant. Cela explique que sur le marché du crédit, différents Agents obtiennent des contrats de crédit identiques, malgré leur différence de qualité. Stiglitz

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et Weiss démontrent aussi que, contrairement à ce que Rothschild et Stiglitz (1976) avaient démontré, cet équilibre peut apparaître simultanément avec un équilibre séparateur.

Intéressons-nous maintenant au second type d'asymétrie d'information : l'aléa moral (cf. figure 1). Dans ce cas, l'asymétrie d'information se situe après la signature du contrat entre le Principal et l'Agent. Pour Holmström (1979), l'aléa moral résulte d'une situation dans laquelle des actions privées de l'Agent peuvent apparaître et modifier son comportement : « Il a longtemps été accepté que le problème d'aléa moral peut apparaître quand des individus s'engagent dans un partage de risque où des actions privées peuvent affecter la distribution du résultat »³.

Arrow (1963) est l'un des premiers à formaliser le problème de l'aléa moral. Pour cela, il prend l'exemple du marché de l'assurance médicale, tel que décrit précédemment. Il explique qu'une assurance ne peut être efficace que si l'Agent, l'assuré, n'a pas de contrôle sur la probabilité d'apparition de l'événement pour lequel il est assuré. Cependant, un tel cas de figure est rare. Or, si l'Agent est capable d'influencer sur les événements, cela risque d'entraîner un comportement opportuniste de sa part. Arrow (1963) prouve que la généralisation de l'assurance santé a entraîné une augmentation des coûts médicaux, les gens allant plus facilement voir leur médecin quel que soit le problème. Shavell (1979a, b) complète les résultats d'Arrow en révélant que les Agents adoptent également un comportement préventif face à la maladie moindre quand ils sont assurés, sachant qu'ils pourront se faire soigner facilement. Dans tous les cas, ce type de comportement opportuniste entraîne une impossibilité pour le marché de se développer.

Une première solution au problème induit par l'aléa moral est le principe de l'incitation : le Principal va inciter l'Agent à agir au mieux de ses intérêts. Reprenons l'exemple du marché du travail. Comment faire coïncider les intérêts des deux parties ? Kreps (1990) démontre qu'une des solutions est de donner à l'Agent un salaire variable indexé aux résultats. Ainsi le Principal et l'Agent auront un intérêt commun : la réussite de l'entreprise. Cette solution permet donc de réduire le potentiel comportement opportuniste.

Si l'ensemble des solutions précédentes étaient basés sur des modèles monopériodiques, Holmström (1979) explique que la plupart des contrats sont basés sur des relations de long terme et que cette relation change le comportement des individus : « quand une même situation se répète plusieurs fois à travers le temps, l'effet de l'incertitude tend à être réduit et les

³ Holmström (1979) p.74

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comportements dysfonctionnels sont révélés plus précisément, réduisant ainsi l'aléa moral »⁴. C'est le principe de répétition. Il s'ensuit que le Principal a intérêt à multiplier les opérations faites avec son Agent afin de détecter un comportement opportuniste.

Ce principe de répétition amènera plus tard le modèle de réputation de Diamond (1991) : à travers le temps et la répétition d'une même action, l'Agent va développer une réputation qui lui permettra d'obtenir des bénéfices dans sa relation avec le Principal, celui-ci craignant moins le problème d'aléa moral. Diamond, sur le marché du crédit, explique que si dans un premier temps, les nouvelles relations sont évaluées et surveillées activement par les banques au moment de l'octroi de crédit et sur son utilisation, cette surveillance se relâche avec le temps. L'explication est que l'entreprise aura acquis une réputation lui permettant d'avoir un accès plus facile au crédit bancaire.

Sharpe (1990) réutilise cette notion de temps et répétition. Il développe sa théorie de la relation de clientèle, ou financement relationnel, comme réponse au problème induit par l'asymétrie d'information. Reprenant les idées de Kane et Malkiel (1965) et de Fama (1985), il explique qu'une banque en relation développe un avantage informationnel sur ses emprunteurs par rapport aux autres banques. Cet avantage informationnel permet de réduire l'asymétrie d'information entre la banque et son client. De plus, il décrit ce financement comme apparaissant « de façon endogène comme une conséquence de l'évolution de l'asymétrie d'information »⁵.

Depuis Sharpe (1990), la notion de financement relationnel a fortement évolué. Ainsi, Rajan (1992), la complète en intégrant la notion de nombre de banques partenaires. Le financement relationnel est un système où la firme privilégie un ou peu de financeurs. En opposition, le système transactionnel est un système où la firme n'aura pas de lien particulier avec une banque, et les mettra en compétition pour choisir un financement. La transmission d'information privée étant coûteuse pour la firme, celle-ci ne pourra simultanément créer plusieurs relations bancaires sans perdre en qualité de transmission. De plus, étant coûteuse pour la banque également, cette dernière ne cherchera pas à développer de relation avec des firmes déjà engagées dans d'autres partenariats financiers.

⁴ Holmström (1979) p.90

⁵ Sharpe (1990) p. 1069.

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Petersen et Rajan (1994) remarquent que l'accumulation d'information ne se fait pas seulement grâce aux prêts. Dans leur modèle, l'ensemble des produits placés auprès du client⁶ est source d'information. Ainsi, le financement relationnel est présenté comme un mécanisme ayant pour finalité d'accumuler l'information privée provenant de la firme, que ce soit à travers les différents prêts déjà octroyés ou les différents produits placés.

Berger et Udell (1995) sont les premiers à présenter le mécanisme d'accumulation d'information comme une composante du relationnel bancaire, et non plus comme une finalité. Ils dénomment ce mécanisme des technologies de financement. Ils en définissent ainsi deux : la première est une technologie de financement relationnel, où la banque va chercher à accumuler de l'information privée sur la firme ; la seconde, une technologie transactionnelle, où la banque va se spécialiser sur des éléments plus factuels, tels que le bilan, compte de résultat et autres ratios financiers. La banque fait le choix de mettre en place un des deux types de technologie de financement. Le financement relationnel bancaire se caractérise donc par une relation de longue durée entre la firme et un partenaire financier principal, où ce dernier s'est spécialisé dans une technologie de financement relationnel. Ils en donnent comme exemple les lignes de crédit. Etant des autorisations à l'avance pour les firmes d'obtenir du financement à leur discrétion, elles nécessitent une confiance envers le client à long terme, confiance qui dépasse la simple analyse des états financiers de la firme.

Ongena et Smith (2000) définissent eux simplement le relationnel bancaire comme « la connexion entre une banque et un client qui va au-delà de la simple exécution de transactions financières anonymes »⁷. Cette définition met en avant le fait que ce type de financement ne se limite pas seulement à l'intermédiation financière, mais à une relation globale, où le client est connu.

Finalement, Boot (2000) propose une définition complète du financement relationnel bancaire : « ce sont des services financiers fournis par un intermédiaire financier qui investit dans l'obtention d'informations spécifiques à son client, souvent propres à la firme et confidentielles, et évalue la rentabilité de ses investissements via de multiples contacts avec le même client à travers le temps ou grâce à d'autres produits »⁸. Cette information est l'information privée. On

⁶ On retrouve des prémices de cette idée chez Alien et Cebenoyan (1991)

⁷ Ongena et Smith (2000) p. 224.

⁸ Boot (2000) p.10.

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retrouve au sein de cette définition l'ensemble des points définis auparavant : (1) le développement d'une relation à long terme, (2) la mise en place d'une technologie de financement basée sur l'accumulation d'information privée, (3) une relation allant plus loin que la simple intermédiation bancaire, (4) l'utilisation de cette information lors des décisions d'octroi de crédit, auquel l'auteur ajoute ainsi un cinquième élément : la nécessité de contact.

Berger *et al.* (2004) complètent en ajoutant que cette information transmise doit rester confidentielle. Le but étant de garder la confiance du client.

Depuis les articles de Stein (2002) puis de Petersen (2004), la nature de l'information utilisée dans la relation banque-firme, s'est affinée. Les auteurs différencient deux types d'information possible : l'information Soft et Hard.

L'information Hard est définie comme une information quantitative. Elle est facilement transmissible et stockable, puis utilisable et vérifiable par tout le monde. Ainsi, elle peut être transmise et utilisée par différentes personnes sans jamais perdre de sa qualité.

L'information Soft est définie, en opposition, comme une information qualitative. Elle ne peut être entièrement vérifiée que par l'émetteur de l'information, l'entreprise. Celle-ci peut cependant la transmettre à d'autres personnes, telles que sa banque, via du temps et de multiples contacts personnels. Cependant, chaque transmission entraîne un coût important pour l'entreprise. Ce coût provient du temps qu'elle passe à établir sa relation avec la banque, afin de transmettre la meilleure information possible et d'être évaluée correctement. Cela explique que toute firme ne développe pas forcément de relationnel. De plus, la transmission en interne, du chargé d'affaires à sa hiérarchie par exemple, entraîne un risque que l'information soit mal interprétée et donc perde en qualité. Ainsi, pour une utilisation optimale, l'utilisateur final doit être la même personne que la personne l'ayant obtenue.

Berger et Udell (2006), reprenant la définition des différentes natures de l'information, donnent une autre définition des technologies de financement que celle qu'ils avaient décrite plus tôt (Berger et Udell, 1995) : « ce sont une unique combinaison de la principale source d'information [Soft ou Hard], des procédures et politiques d'octroi et de contrôle de crédit, de la structure du contrat de crédit ainsi que des stratégies et mécanismes de surveillance »⁹. Ils

⁹ Berger et Udell (2006) p.2948.

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définissent deux types de technologie de financement se caractérisant par leur principale source d'information :

- La technologie de financement relationnelle, qui utilise l'information Soft ;
- La technologie de financement transactionnelle, qui utilise l'information Hard.

De plus, ils déclinent ces technologies en huit catégories détaillées dans le tableau ci-dessous :

Tableau 1 : liste des différentes technologies de financement définies par Berger et Udell (2006)

Nom	Source de l'information utilisée	Financement
Etats financiers	Information comptable, ratios comptables, certification des comptes.	Transactionnel
Score de crédit des PME	Information comptable mais aussi information liée au dirigeant (historique de crédit personnel par exemple).	Transactionnel
Actifs courants	Valeur des actifs circulants (stocks ou créances clients) placés en garantie.	Transactionnel
Actifs immobilisés	Valeur des actifs immobilisés (équipement ou immobilier) placés en garantie.	Transactionnel
L'affacturage	Valeur du poste client, dont la banque devient propriétaire, financé par l'affacturage.	Transactionnel
Le Crédit-Bail	Valeur de l'actif, dont la banque est le propriétaire, financé par crédit-bail.	Transactionnel
Le relationnel	Information qualitative accumulée par la banque à travers une relation.	Relationnel
Le crédit fournisseur	Historique des achats, des remboursements de crédit fournisseur passé / Accumulation d'une information privée.	Transactionnel / Relationnel

Ils définissent ainsi six technologies de financement transactionnel, une relationnel et le cas du crédit fournisseur. Ce dernier est présenté initialement comme un financement principalement transactionnel, utilisant comme information l'historique des achats mais aussi l'historique des remboursements des crédits passés. Cependant, Biais et Gollier (1997) démontrent qu'au fil de la relation, le fournisseur accumule de l'information privée sur son client, information qu'il va utiliser lors de la décision d'octroi de crédit. Ce mode de fonctionnement correspondant plus à un financement relationnel. De plus, Uchida *et al.* (2013) font le parallèle entre cette information privée et l'information Soft définie par Stein (2002) et démontrent que le crédit-fournisseur correspondrait plus à un financement relationnel que transactionnel.

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Ainsi, le financement relationnel bancaire est une notion ayant fortement évolué durant ces dernières années, mais il reste des questions non résolues. Cependant plusieurs éléments semblent récurrents : (1) la durée de la relation entre la firme et la banque, (2) le faible nombre de financeurs de la firme et l'exclusivité de la relation, (3) la forte intensité de la relation, à travers de nombreux contacts et services fournis par la banque, et enfin (4) la technologie de financement relationnelle utilisée (basée sur l'information Soft).

A contrario, depuis Rajan (1992), la définition du financement transactionnel bancaire a peu évolué. Il repose sur le principe que les banques ne cherchent pas à développer de relation avec leur client. Le but de ce financement est d'octroyer du crédit aux clients, sans chercher à développer de relation en contrepartie. De plus, la décision d'octroi de crédit est basée principalement sur l'information publique, ou information Hard, disponible sur les clients (les états financiers, la valeur des biens de la firme, ...). Les banques transactionnelles sont utilisatrices d'une technologie de financement transactionnel (Berger et Udell, 2006).

C'est au sein de ce champ de réflexion sur la structure de la relation de clientèle, et plus précisément de la technologie de financement relationnel, que nous positionnons cette thèse

2 Les questions de recherche

2.1 Champ d'investigation

Notre réflexion se porte sur trois questions de recherche ayant pour thème central la technologie de financement relationnel. Nous déclinerons ce thème en trois axes.

Dans toute étude de nature empirique, la question de la mesure est centrale. Or, la technologie relationnelle est un mécanisme complexe à quantifier. Ce financement repose sur deux principes : la transmission d'information qualitative par la firme ; et son utilisation par la banque. Le principal obstacle lors de la mesure de ce financement est la nature de l'information. En opposition à l'information quantitative, l'information qualitative est difficilement mesurable et évaluable. Cela entraîne deux conséquences. Premièrement, il ne suffit pas de savoir si la firme a émis de l'information qualitative, il faut aussi savoir si la banque l'a utilisée. Une firme, émettant de l'information qualitative, peut se trouver en relation avec une banque ne gérant pas cette dernière. Il est donc nécessaire d'appréhender ces deux grandeurs. Deuxièmement, même si nous savons que la banque utilise cette information, comment pouvons-nous la mesurer. Ainsi, la première étape sera de comprendre comment créer une mesure résolvant ces deux

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problèmes. Une fois la nouvelle mesure créée, nous l'utiliserons pour amener une réponse à la question de l'influence de la concentration bancaire sur la mise en place d'une technologie de financement relationnel. Deux théories s'opposent. D'une part, le financement relationnel est vu comme une protection pour la banque contre la compétition bancaire. La mise en place du financement relationnel étant coûteux pour la firme, car nécessitant du temps, cette dernière changera difficilement de banque une fois ce financement établi. D'autre part, le financement relationnel est également coûteux à mettre en place pour la banque, car il nécessite de nombreux contacts avec le client. Ainsi, la banque n'en proposera pas lorsque la compétition est importante. Notre question de recherche est donc : **Quel est l'impact de la compétition du marché bancaire sur la mise en place de la technologie de financement relationnel ?**

Un des buts de la technologie de financement relationnel est de réduire l'asymétrie d'information existante entre la banque et la firme. Cette réduction permet à la banque d'évaluer avec plus de précision la firme. La banque peut ainsi lui proposer plus fréquemment des crédits, adaptés à sa situation. Le financement relationnel permet donc de réduire le rationnement de crédit subi par les firmes initialement difficiles à évaluer, autrement dit opaques. Il est intéressant d'analyser si ce résultat est identique pour les minorités, ethniques et de genre. En effet, ces derniers subissent de fortes discriminations sur le marché du crédit, entraînant une augmentation de leur rationnement. Nous opposons ici deux aspects du financement relationnel qui peuvent jouer de manière contradictoire : d'un côté, la mise en place du financement relationnel permet de réduire l'asymétrie d'information et d'augmenter la connaissance, par la banque, du client. Elle permettrait donc de passer outre un préjugé discriminatoire - cette théorie fait écho à la théorie d'Allport (1954) connue en psychologie comme la théorie du contact. D'un autre côté, le système relationnel est un système qui laisse plus de discrétion au chargé d'affaires quant à la décision d'octroi de crédit. Cela permettrait ainsi à ce dernier de pouvoir discriminer plus facilement. Ainsi, notre deuxième partie répond à la question : **Les minorités peuvent-elles utiliser la technologie de financement relationnel afin de réduire la discrimination ?**

Les deux premières parties traitent de la mesure de la technologie de financement relationnel et de son impact lorsque celui-ci est mis en place. Cependant, il peut être impossible pour les firmes de trouver ce type de financement. La troisième partie étudie la question de la substitution du financement relationnel quand celui-ci est déficient. La première question que nous pouvons nous poser est de savoir s'il existe d'autres financeurs pouvant proposer une technologie relationnelle. Une réponse potentielle provient du fournisseur. De par sa nature, le

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fournisseur est un partenaire financier accumulant de l'information sur son client. Cette information est, dans un premier temps, de nature quantitative, à travers les commandes et le remboursement des différents crédits octroyés. Cependant, au fil de la relation, le fournisseur acquiert également de l'information qualitative sur son client, telle que les capacités de gestion de celui-ci, la confiance établie. Ainsi, la question que nous nous posons est donc : **Le crédit fournisseur est-il un substitut à une technologie de financement relationnel déficiente ?**

2.2 *Les données utilisées*

Cette thèse est de nature empirique. Chaque question de recherche est traitée par un modèle statistique.

Nous utilisons principalement deux sources de données : le *Survey of Small Business Finances 2003 (SSBF 2003)* ainsi que le *10th Survey of Italian Manufacturing Firms (SIMF)*.

Ces deux bases de données contiennent des informations sur des PME. L'intérêt de travailler sur ce type d'entreprises est qu'elles sont fortement opaques et souffrent donc le plus des problèmes d'asymétrie d'information. Ce sont aussi celles pour qui le relationnel bancaire a le plus d'avantages.

Les deux premières parties sont basées sur la base de données SSBF 2003. Cette base est américaine et contient des informations sur 4240 PME, définies ainsi car ayant moins de 500 équivalents temps-plein. Elle présente plusieurs intérêts dans notre cas. Premièrement, la plupart des études empiriques sur des sujets similaires se basent sur les Etats-Unis. Ainsi, cela nous permet de confronter nos résultats à ceux existant au préalable. Deuxièmement, la base de données contient des informations sur le genre et l'origine des dirigeants ce qui nous permet de traiter de la question de la discrimination. Finalement, elle contient aussi des informations sur le dernier crédit octroyé. Ces informations nous permettront de créer notre mesure de la technologie de financement utilisée lors du dernier crédit.

Notre troisième partie est basée sur la base de données SIMF. Cette base contient des informations sur 5137 PME italiennes ayant plus de 10 employés. Cette base présente plusieurs intérêts également. Premièrement, l'Italie est un pays dans lequel le crédit fournisseur est la deuxième source de financement des PME, après le crédit bancaire. Deuxièmement, la base contient des données sur la perception de la nature de la banque par la firme. Cette information nous permet donc d'analyser la réaction de la firme face à sa perception de sa relation avec la banque.

2.3 Résultats et contribution

Cette thèse présente trois résultats principaux, permettant d'enrichir notre compréhension de la technologie de financement relationnel.

Le premier résultat concerne l'impact de la concentration bancaire sur la mise en place d'une technologie de financement relationnel. A notre connaissance, nous sommes les premiers à prouver empiriquement que les banques favorisent une technologie de financement transactionnel lorsque la compétition est faible, relationnel lorsqu'elle s'intensifie avec un retour au transactionnel en cas de forte compétition. Notre résultat confirme des résultats théoriques précédents présentant le financement relationnel comme une protection contre la compétition bancaire, protection cependant incomplète. A ce résultat, s'ajoute une contribution d'ordre méthodologique : la création d'une mesure précise de la technologie de financement utilisée. Cette mesure est basée sur des données issues du la SSBF 2003, et est donc facilement duplicable dans d'autres articles.

Concernant les minorités, nous montrons que le financement relationnel tend à aggraver, dans un premier temps, les discriminations subies. Cependant, cette discrimination diminue avec la durée de la relation. Ces résultats montrent que les multiples contacts initiaux qu'implique le financement relationnel ne font qu'accentuer les préjugés du chargé d'affaires. Cependant, au fil des contacts, la connaissance du client semble remplacer les préjugés. Ce qui explique que la discrimination subie diminue. Ce résultat fait écho à la théorie du contact d'Allport (1954) dans laquelle la connaissance d'un individu est présenté comme solution aux problèmes de discrimination qu'il pourrait subir.

Enfin, notre troisième résultat montre que le crédit fournisseur semble être un substitut à une technologie de financement relationnel déficiente. Les firmes cherchant du financement relationnel n'en trouvant pas présentent une part de crédit fournisseur significativement supérieure aux autres. Le fournisseur joue un rôle similaire aux banques relationnelles, à savoir l'accumulation et l'utilisation d'une information Soft sur ses clients.

3 Littérature

3.1 Coûts et avantages liés à l'utilisation du relationnel bancaire

3.1.1 Pour la firme

Le premier avantage du relationnel bancaire reste la réduction de l'asymétrie d'information. Celle-ci se fait à travers l'accumulation par la banque de l'information Soft émise par la firme. Cela a des conséquences sur les conditions de crédit, plus précisément sur la disponibilité, le taux et la présence de garanties.

Dans le cas de la disponibilité, une forte asymétrie d'information peut entraîner un rationnement bancaire de la firme (Stiglitz et Weiss, 1981). Une banque dans l'incapacité d'analyser correctement son client, ne prendra pas de risque. La conséquence est qu'elle ne prêtera pas à la firme, ou proposera un taux tel que la firme ne pourrait l'accepter. A travers l'accumulation d'information Soft, la banque peut réduire l'asymétrie d'information et donc analyser correctement la qualité de l'entreprise. Elle peut ainsi proposer plus facilement des crédits adaptés à sa situation. Ce résultat est démontré empiriquement par Petersen et Rajan (1994), Uzzi (1999) ou encore Dietsch (2003).

Si l'on regarde le taux de crédit, les résultats sont plus mitigés voire contradictoire (voir Degryse *et al.*, 2009 pour une littérature complète). Une explication est que si le relationnel bancaire tend à réduire l'asymétrie d'information, il entraîne aussi le risque de « hold-up informationnel ». Le problème du hold-up est une conséquence du monopole informationnel tel qu'expliqué par Sharpe (1990) : la transmission d'information étant coûteuse pour la firme, celle-ci ne changera pas facilement de banque, de crainte de devoir tout recommencer et donc de repayer les coûts. Elle se retrouve donc captive de la banque. Grâce à ce monopole informationnel, la banque va pouvoir facturer un taux d'intérêt plus élevé à la firme capturée (Rajan, 1992). On retrouve des évidences de cette capture informationnelle chez Santos et Winton (2008) ou encore Ioanniodou et Ongena (2010).

Cependant, Sharpe (1990) montre également qu'abuser de ce monopole informationnel est risqué pour la banque : la réputation des banques circulant entre les firmes, une banque profitant trop de sa situation verra sa réputation diminuer et ainsi sa clientèle se réduire. Pour régler ce problème, Sharpe (1990), suivi par Berger et Udell (1992), démontre que la banque et la firme vont instaurer un contrat implicite : la firme accepte de payer plus cher son crédit lorsqu'elle se

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porte bien, si la banque, en contrepartie, accepte de prêter à des taux plus bas lorsque la firme rencontre des difficultés financières. Ainsi, d'un côté la firme accepte de ne pas profiter de l'avantage qu'elle pourrait tirer de l'émission d'information Soft lors d'une bonne situation financière. De l'autre, la banque accepte de ne pas profiter de l'avantage que lui procure cette information en situation de problème financier. Ce contrat implicite est donc une assurance pour la firme d'obtenir un financement bancaire en cas de période financière tendue, qui limiterait un accès au crédit bancaire transactionnel. Il permet également à la banque d'analyser correctement la solvabilité de l'entreprise (Berlin et Mester, 1999 ; Bolton *et al.*, 2016). Il représente le deuxième avantage du financement relationnel.

Si le contrat implicite implique un soutien de la banque à la firme en cas de difficulté, celui-ci ne doit pas être abusif. Supposons une firme dans une situation financière difficile. Afin de faire face à ses difficultés, elle décide de demander un crédit supplémentaire auprès d'une banque. Au vu de la situation, un nouveau financeur ne prêterait pas, de crainte de voir l'entreprise faire défaut. Hellwig (1977) montre, qu'à contrario, un financeur ayant déjà prêté à celle-ci pourrait décider de la soutenir. Son but étant de récupérer les crédits déjà octroyés. Dewatripont et Maskin, (1995) montrent que cette situation peut amener un comportement opportuniste de l'entreprise. Si elle se rend compte qu'elle peut renégocier facilement les termes du contrat en cas de difficulté financière, cela risque d'impacter son comportement au préalable, et la pousser à prendre plus de risques que prévus, et ainsi détériorer sa situation plus vite. C'est ce qu'on appelle le problème de *Soft-budget constraint* (mis en évidence également par Bolton et Scharfstein, 1996).

Kysucky et Norden (2016) publient une méta-analyse sur le sujet des bénéfices du relationnel bancaire sur les conditions de crédit, à travers différents pays. Ils démontrent que sur un échantillon de 101 analyses empiriques précédentes, 35% montrent un effet bénéfique du relationnel bancaire pour l'emprunteur, 21% un effet négatif et 44% une absence de résultat. En outre, ils relèvent qu'une longue relation entraîne des avantages tant pour la firme, à travers une meilleure disponibilité de crédit à un meilleur taux, que pour la banque, avec plus de ventes additionnelles. La disponibilité de crédit augmente aussi avec la proximité entre la banque et la firme. En ce qui concerne l'exclusivité de la relation, une entreprise avec un unique partenaire financier aura un taux de crédit plus faible que les autres, mais devra en contrepartie fournir plus de garanties. Les auteurs démontrent également que la structure du marché bancaire joue un rôle important dans le compromis bénéfices/coûts : les bénéfices du relationnel bancaire

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semblent plus importants lorsque la firme se situe dans une zone où la compétition bancaire est importante. Finalement, ils relèvent également un effet « pays » : les Etats-Unis présentent des bénéfices plus importants que l'Europe.

Autre avantage du relationnel bancaire : la confidentialité des données. Supposons une entreprise avec une activité de recherche et développement. L'ensemble de ses états financiers ne permettent que peu d'inférer la nature des projets de R&D et leur qualité. Afin d'obtenir un financement, la firme va devoir communiquer de nombreuses informations qualitatives sur ses projets. Le but est de permettre à la banque de l'évaluer correctement et d'obtenir ainsi un taux correspondant à sa véritable qualité. Cependant, cela représente un risque important pour la firme : que la concurrence récupère cette information. Bhattacharya et Chiesa (1995) démontrent que le développement d'une relation de clientèle à long terme permet à la firme de divulguer ce type d'information à sa banque. Celle-ci a tout intérêt à maintenir la confidentialité, afin de gagner un avantage informationnel sur la firme et réduire la concurrence.

Finalement, indirectement, le relationnel bancaire est créateur de valeur pour la firme. En se basant sur une méthodologie empirique d'étude d'évènements, Lummer et McConnell (1989) démontrent qu'un renouvellement de crédit entraîne des rendements anormaux plus importants qu'un premier octroi. Cela tend à prouver une création de valeur plus importante lorsqu'une relation bancaire préexiste. Ces résultats ont été retrouvés dans de nombreux articles (Best et Zhang, 1993, ou encore Billet *et al.*, 1995, entre autres). Slovin *et al.* (1992) démontrent en plus que les réactions du marché sont plus importantes pour les petites firmes, considérées comme ayant une forte asymétrie d'information. Enfin, Slovin, *et al.* (1993) montrent que la faillite d'une banque entraîne une chute anormale du cours des firmes en relation. Cela conforte l'idée que les investisseurs perçoivent la relation avec la banque comme génératrice de valeur.

3.1.2 Pour la banque

Si de nombreuses études se sont penchées sur les coûts et bénéfices du relationnel bancaire pour la firme, peu ont étudié ces paramètres du point de vue de la banque. A notre connaissance, seuls Mester *et al.* (2007) étudient les bénéfices du relationnel bancaire pour la banque sur le marché des entreprises. Ils démontrent que les banques, à travers l'information qu'elles acquièrent grâce à leur relationnel avec les firmes, pourront mieux contrôler les crédits qu'elles octroient. Ce contrôle se traduit de deux façons : premièrement, comme expliqué précédemment, le relationnel réduit les comportements opportunistes de la firme ; deuxièmement, le relationnel donne accès à des garanties supplémentaires. Les auteurs

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montrent, en effet, que le relationnel bancaire permet aux banques d'avoir accès aux stocks et créances clients de leurs clients.

Agarwal *et al.* (2010) prouvent que le développement du relationnel minimise le risque de contrepartie du portefeuille clients de la banque. Les banques relationnelles ont un taux de défaut plus faible que les banques transactionnelles. Cela s'explique par le fait que l'information Soft est de meilleure qualité que l'information Hard, et permet donc une analyse plus fine. Cela permet aux banques de proposer des produits en adéquation avec le profil de ses clients et ainsi de réduire leur risque de non-remboursement. Les auteurs montrent aussi que les banques relationnelles présentent non seulement un taux d'attrition de leur clientèle plus faible, mais que leurs clients utilisent aussi des services générant du produit net bancaire (PNB) important plus souvent (tels que la carte de crédit). Ainsi, ces banques relationnelles ont des clients non seulement plus fidèles, mais aussi plus rentables. Santikian (2014) constate également que les banques développant un relationnel vendent plus de produits, hors intermédiation, que les autres. Cela contribuant également à un gain de PNB supplémentaire.

Enfin, pour Kysucky et Norden (2016), la relation de long terme, qu'implique le relationnel bancaire, offre un avantage concurrentiel à la banque sur les offres de prêt vers de nouveaux clients. En effet, la relation de long terme permet à la banque relationnelle un lissage dans le temps de ses taux d'intérêts : elle peut réduire sa marge à un moment donné, sachant qu'elle pourra compenser plus tard. Ce raisonnement est valable également à l'entrée en relation : sachant qu'elle pourra se rattraper une fois la relation établie, la banque relationnelle va pouvoir être très concurrentielle face aux clients potentiels.

3.2 Déterminants du développement du relationnel bancaire

Nous avons vu que la mise en place du relationnel bancaire est coûteux, tant pour l'entreprise que pour la banque. Seules certaines entreprises et certaines banques tirent assez d'avantages pour avoir un intérêt à développer ce relationnel. Nous verrons ainsi quels sont les déterminants, tant d'un point de vue de la firme que de la banque, de sa mise en place.

De plus, ce type de relation est influencé par d'autres paramètres : certains liés aux caractéristiques mêmes de la relation entre la firme et sa banque, telles que la distance les séparant, d'autres liés à l'environnement dans lequel les agents évoluent, par exemple la concentration sur le marché bancaire. Nous présenterons ainsi ces deux impacts supplémentaires.

3.2.1 Les firmes

Les petites et moyennes entreprises sont souvent caractérisées comme étant opaques et dépendantes de leur banque (Petersen et Rajan, 1994). En comparaison, les grosses entreprises ont un accès plus aisé à des sources de financement autres, telles que le marché financier. Cette dépendance des PME se traduit par le besoin d'être correctement évaluées par leur banque, afin d'être le moins possible rationnées. Cependant, leur opacité rend leur analyse compliquée. McCann et McIndoe-Calder (2015) démontrent que pour les PME, le score de crédit, évaluant la qualité de la firme par la banque, est moins performant que pour les grandes entreprises. Ainsi, ces entreprises se trouvent obligées de jouer sur un autre type d'information : l'information Soft. Elles sont donc à la recherche de banques mettant en place des technologies de financement gérant cette information : les banques relationnelles. Ces entreprises sont souvent de petites entreprises, jeunes, car elles ne possèdent que peu d'information Hard à émettre sur le marché.

On retrouve par ailleurs un autre type d'entreprise demandeuse de ce type de financement relationnel : les entreprises ayant beaucoup d'actifs intangibles, et principalement de la recherche et développement (Edmans *et al.*, 2013). Ces actifs sont par nature quasiment impossibles à évaluer. Leur valeur repose principalement sur la confiance que l'on porte au dirigeant de l'entreprise. Par ailleurs, les entreprises travaillant dans la R&D recherchent aussi du financement relationnel pour la confidentialité assurée par la banque quant à leurs données (Berger *et al.*, 2004).

3.2.2 Les banques

Concernant les banques, Berger *et al.* (2005) démontrent que le principal déterminant est la structure de décision. On retrouve deux types de structure de décision. La première est une structure centralisée avec une forte hiérarchisation : dans ce type de structure, les décisions de crédit sont prises par des comités de crédit indépendants des chargés d'affaires. Par ailleurs, il existe souvent plusieurs strates de décision intermédiaires entre le chargé d'affaires, qui récolte l'information, et le comité de décision. Le second type de structure est une structure décentralisée : la prise de décision se fait souvent au même niveau que le chargé d'affaires, soit par celui-ci directement, soit par un comité dont il fait partie.

Comme vu précédemment, l'information Soft est une information qualitative, difficilement transmissible et qui perd de sa qualité quand elle doit l'être. L'information Hard, elle, est facilement transmissible et peut être analysée par plusieurs personnes sans jamais perdre en qualité. Ainsi, les structures de décision centralisées et hiérarchisées n'ont que peu d'avantages à utiliser l'information Soft. A contrario, elles peuvent mettre en place des systèmes de traitement de l'information Hard, leur permettant de faire des économies d'échelle importantes sur le traitement de l'information. A l'opposé, les structures de décisions décentralisées laissent toute latitude au chargé d'affaires de pouvoir exploiter l'ensemble de l'information Soft qu'il a accumulée sur la firme. Elles se spécialisent donc plus naturellement vers le relationnel bancaire.

Berger *et al.* (2005), suivis par Cole *et al.* (2004), Berger et Udell (2006) ou encore Berger *et al.* (2008), démontrent que l'on retrouve les structures de décision centralisée dans les grosses banques, de niveau national ou international, voire étrangères ; et les structures de décision décentralisée dans les petites banques locales.

3.2.3 Les caractéristiques de la relation

Parmi les déterminants du relationnel bancaire, la question de la distance entre la firme et la banque a été étudiée régulièrement. En effet, l'agrégation d'information Soft par la banque nécessite de multiples contacts entre la firme et celle-ci, et ces contacts peuvent être favorisés par une distance géographique faible entre les deux acteurs.

Petersen et Rajan (2002) démontrent que la distance est un bon indicateur du relationnel bancaire mais que la pertinence de cet indicateur décroît avec le temps. Berger *et al.* (2005) accentuent ce résultat en expliquant que la distance entre la banque et la firme est un indicateur

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biaisé : si initialement les jeunes firmes cherchent des banques proches, dans le but d'optimiser la transmission de leur information Soft, elles ne déménagent cependant pas lorsqu'elles commencent à émettre plus d'information Hard. Il est donc tout à fait logique de trouver des grosses firmes près de leur banque. La distance entre la banque et la firme ne peut donc être que la conséquence d'un choix initial de la firme. Toutefois, Brevoort *et al.* (2010), analysant des données de 1993 à 2003, montrent que la distance a augmenté avec le temps. De plus, cela ne concerne principalement que les grosses firmes ainsi que les financements basés sur les actifs, et donc transactionnels. Pour les financements relationnels, la distance n'a qu'augmenté un peu voire pas du tout. La distance resterait donc un indicateur de la nature du financement.

Agarwal et Hauswald (2010) prouvent qu'il ne faut pas seulement prendre en compte la distance banque-firme, mais aussi la distance de l'entreprise au premier concurrent bancaire. Ils montrent qu'une faible distance entre la banque et la firme tend à favoriser l'accumulation d'information Soft et le développement d'un relationnel bancaire. Cependant, la présence d'un compétiteur à une distance similaire tend également à augmenter la probabilité que la firme change de banque, et ainsi réduit l'intérêt du relationnel bancaire.

La deuxième caractéristique de la relation jouant sur la nature du financement développé est le mode de contact entre la firme et la banque. Pour Berger *et al.* (2005) le développement d'un relationnel bancaire passe par des contacts personnels, face à face, et non impersonnels, par mail, téléphone ou internet. Ces contacts personnels sont nécessaires pour transmettre correctement l'information Soft.

3.2.4 Les paramètres environnementaux

Si l'ensemble des études prouvent qu'il existe un lien entre la compétition du marché de crédit et la création d'un relationnel bancaire, la relation en elle-même est soumise à controverse. D'un côté, Petersen et Rajan (1995) développent un modèle théorique où la compétition et le relationnel bancaire ne peuvent cohabiter : la compétition permettant aux firmes de changer de banque facilement, la banque n'a aucun intérêt à mettre en place un relationnel bancaire. Cette théorie a été prouvée empiriquement par Ogura (2010) et Ogura (2012) parmi d'autres. A l'opposé, Boot et Thakor (2000) mettent en évidence que la compétition tend à augmenter la probabilité que les banques développent du relationnel bancaire : au vu de la difficulté et du temps nécessaire à développer ce relationnel, celui-ci est une protection contre la compétition. Leur argument est que les firmes ne souhaitent pas redéployer du temps et de l'argent supplémentaire pour développer une nouvelle relation avec une autre banque. Cette théorie a

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aussi été validée empiriquement par Bonfim *et al.* (2009) et Black et Strahan (2002) entre autres. Dinç (2000) réunit les deux précédentes théories dans un modèle où il explique que si le relationnel bancaire représente une protection contre la compétition, cette protection n'est pas absolue. Passé un seuil de compétition, la banque favorisera des relations transactionnelles. Cependant si nous trouvons des résultats empiriques prouvant cette non-linéarité, ces résultats sont en contradiction avec la théorie : les banques utilisent dans un premier temps du relationnel, puis du transactionnel et enfin du relationnel à nouveau (Elsas, 2005). Presbitero et Zazzarro (2011) mettent en évidence que la compétition ne tend qu'à faire recentrer les banques vers leur cœur de métier : relationnel pour les petites banques et transactionnel pour les plus grosses.

Le milieu informationnel dans lequel se trouve la banque joue aussi un rôle important. La présence d'un acteur tiers dont le rôle est la certification des comptes, l'émission de notation de crédit ou toute autre information sur la performance de la firme, permet à la banque de gagner du temps et d'être plus performante sur la prédiction de défaut de ses clients (Miller, 2003). De plus, cette présence entraîne aussi des conséquences positives pour les firmes puisqu'elles voient leur probabilité d'obtenir un crédit augmentée (Love et Mylenko, 2003). Cette présence est directement liée à une des technologies mises en évidence par Berger et Udell (2006) : l'utilisation du score de crédit pour les PME. En effet, et principalement aux Etats-Unis, la plupart des banques délèguent la création de ses fonctions de score à des sociétés externes¹⁰. Ainsi en l'absence de ce type de service dans leur environnement, ces banques n'auront pas accès à cette technologie de crédit. De plus, Klapper (2006) démontre que la présence de ces acteurs est fortement liée à la présence d'affacturage par les banques, autre type de financement transactionnel.

Finalement, le dernier paramètre externe impactant le choix d'un financement relationnel ou transactionnel est l'environnement légal et judiciaire. Il n'existe, à notre connaissance, aucune étude directe reliant le relationnel bancaire au système juridique et légal. Cependant, nous pouvons retrouver indirectement des liens entre ces deux éléments. Berkowitz et White (2004), mais aussi Sharpe (1990), ont démontré que l'environnement légal jouait un rôle important dans la structure des contrats de crédit, que ce soit la maturité du crédit, la présence de garantie personnelle ou de la société. Klapper (2006) montre que la garantie n'a d'intérêt que si

¹⁰ Nous pouvons citer par exemple la cotation Dun & Bradstreet principalement utilisée pour les PME

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l'environnement légal reconnaît aux prêteurs un statut prioritaire en cas de faillite de la firme. Dans le cas contraire, il démontre que les banques ont tendance à favoriser d'autres types de financement tels que l'affacturage ou le crédit-bail, où la propriété du bien reste à la banque.

3.3 Les mesures du relationnel bancaire

Si le mécanisme du relationnel bancaire n'est déjà pas évident à modéliser théoriquement, le passage à l'empirique a posé une question supplémentaire importante : celle de la mesure du relationnel bancaire.

Nous retrouvons de nombreuses mesures du relationnel bancaire au sein de la littérature. Ceci peut s'expliquer, tout d'abord, par le fait que ce mécanisme est complexe. En effet, comme vu précédemment, il est composé de plusieurs éléments à prendre en compte. De plus, certains de ces éléments sont par nature difficiles à mesurer. Nous pouvons citer par exemple l'information Soft utilisée. Etant une information qualitative, difficilement transmissible et reproductible à l'écrit, elle est difficile à mesurer.

Ainsi, l'ensemble des mesures que l'on retrouve capturent l'information de façon détournée.

Une première série de mesures se basent sur les déterminants du relationnel bancaire. A défaut d'être capables de mesurer directement le relationnel bancaire, ces mesures capturent la présence des éléments impliquant un relationnel bancaire.

Une deuxième série de mesures se basent sur les composantes du relationnel bancaire. Si le relationnel est compliqué à mesurer dans son intégralité, nous pouvons cependant mesurer chacune de ses composantes (la durée de la relation, le nombre de partenaires financiers, l'intensité de la relation et l'information utilisée).

Nous verrons une description de ces différentes mesures ainsi que les avantages et inconvénients à leur utilisation.

3.3.1 Mesures et déterminants du relationnel bancaire

Les premières mesures utilisées sont celles basées sur les déterminants du relationnel bancaire. Ainsi, nous retrouvons naturellement des mesures des caractéristiques de la firme, de la banque et de leur relation.

3.3.1.1 Nature des mesures

Les premières mesures sont basées sur le niveau d'opacité de la firme. Celui-ci peut être capturé par plusieurs variables cherchant à mesurer la nature et la quantité d'information émise par la firme. Nous retrouvons ainsi :

- *L'âge de la firme*. Ce proxy est utilisé pour mesurer la quantité d'information publique, ou Hard, disponible sur la firme (Petersen et Rajan, 1994 ; Berger *et al.*, 2005). Plus vieille est la firme, et plus elle a d'information Hard. Ainsi, ce proxy est négativement corrélé à la présence potentielle d'un relationnel.
- *La taille de la firme*. Berger *et al.* (2001) démontrent qu'une entreprise de petite taille favorise l'information Soft par rapport à une firme de grande taille. Celle-ci est en effet capable d'émettre plus facilement de l'information Hard.
- *Le niveau d'actifs intangibles / de recherche et développement* (Edmans *et al.*, 2013). Ces deux actifs n'ayant pour seule valeur que celle qu'on veut bien leur donner.
- *Le niveau d'éducation/d'expertise du dirigeant* (Grunert et Norden, 2012). Un dirigeant ayant un bon niveau d'étude ou d'expertise est souvent perçu comme quelqu'un en qui on peut avoir confiance.
- Finalement la *quantité d'information Hard* disponible sur la firme. Celle-ci est le plus souvent mesurée via la cotation de la firme ou de son dirigeant (Berger *et al.*, 2011) ou encore la présence d'états financiers certifiés par un tiers (Berger et Black 2011). Cette mesure est donc naturellement négativement corrélée à la présence du relationnel bancaire.

En ce qui concerne les déterminants de la banque, de nombreux auteurs (Berger *et al.*, 2005 ; Cole *et al.*, 2004 ; Berger et Udell, 2006 ; ou encore Berger *et al.*, 2008) ont démontré que la *taille* et le *statut* de la banque étaient étroitement liés à son système de délégation de crédit. Les banques relationnelles sont le plus souvent de petites banques locales, alors que les banques transactionnelles sont des banques d'envergure nationale voire internationale et pouvant parfois appartenir à des groupes étrangers. Il est donc naturel de retrouver ces deux variables comme proxy de la stratégie bancaire. A ces variables s'ajoutent souvent un troisième proxy : la *distance fonctionnelle* (Alessandrini *et al.*, 2009) aussi appelée *distance organisationnelle* (Jiménez *et al.*, 2009). Cette variable est un proxy de la distance entre les différents niveaux de hiérarchie au sein des banques. Une distance fonctionnelle importante est donc synonyme d'un éloignement important entre les branches des banques, recevant l'information, et le siège,

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traitant l'information. Ainsi, plus grande est la distance fonctionnelle et plus la transmission d'information Soft est faible, et donc plus la banque est considérée comme transactionnelle.

3.3.1.2 Limite des mesures

Si ces mesures présentent une réelle facilité d'utilisation et de compréhension, elles présentent cependant plusieurs limites.

La première est qu'elles ne sont basées que sur des généralités concernant les caractéristiques des banques ou des firmes. Ainsi, une grande banque sera systématiquement analysée comme transactionnelle, et une petite comme relationnelle. Cependant, Bartoli *et al.* (2013) démontrent que les banques peuvent utiliser les deux systèmes de façon conjointe. Cela dépend de plusieurs paramètres tels que la nature du client. Ainsi, il faudrait plutôt se focaliser sur chaque relation individuellement plutôt que sur la banque ou la firme en général.

Une autre limite est de savoir comment gérer les couples banque-firme quand les deux agents présentent des caractéristiques informationnelles opposées : que choisir si une petite entreprise se retrouve face à une grande banque, ou inversement si une grande entreprise décide d'emprunter à une petite banque ? doit-on ainsi favoriser la banque ou la firme ? Nous retrouvons ce problème avec les articles de Montoriol-Garriga (2005) et de Petersen et Rajan (1995). Ces deux articles traitent de la même question de recherche : quel est l'impact de la concentration du marché bancaire sur le choix de la technologie de financement ? Ils s'appuient également sur la même base de données (la NSSBF 1988). Cependant, leur mesure de la technologie de financement diffère : le premier se base sur une mesure du côté de la banque, à travers le nombre de banques de la firme, alors que le deuxième du côté de la firme, à travers l'âge. Le problème est que ces deux articles trouvent des résultats empiriques différents : pour Petersen et Rajan (1995) une concentration bancaire ne peut aller de pair avec un financement relationnel, alors que Montoriol-Garriga (2005) montrent que cette concentration bancaire favorise l'utilisation de l'information Soft.

Finalement, une dernière limite provient de Ferri et Murro (2015). Ils expliquent qu'il existe plusieurs phénomènes externes pouvant impacter fortement le processus de gestion d'information de la banque, sans forcément impacter sa taille ou son statut. Parmi ces phénomènes, nous pouvons citer la crise financière (Hale, 2011), ou encore une fusion-acquisition par une autre banque (Bonaccorsi Di Patti et Gobbi, 2007).

3.3.2 Mesures et composantes du relationnel bancaire

Le relationnel bancaire se qualifie par quatre caractéristiques fondamentales : (1) une longue durée de la relation entre la firme et la banque, (2) un partenaire financier principal, (3) une forte intensité de la relation et enfin (4) une technologie de financement relationnelle utilisée. Certaines mesures vont donc chercher à capturer directement une ou plusieurs de ces quatre composantes.

3.3.2.1 Durée, intensité et exclusivité

Les mesures les plus communément utilisées dans les articles empiriques concernent le temps, l'intensité et l'exclusivité de la relation entre la banque et la firme.

3.3.2.1.1 La durée de la relation

Le temps est une mesure indirecte de l'importance des interactions entre la firme et la banque. Il est donc lié à l'apprentissage et à l'accumulation d'information par la banque sur la firme (Boot, 2000). Il est mesuré par deux variables :

- *La durée de la relation.* Utilisé comme proxy de la quantité d'information privée que la banque peut obtenir de la firme (Ogura, 2010). Cette variable est donc synonyme d'un système relationnel.
- *L'âge de la firme.* Utilisé comme proxy de la durée de la relation entre l'entreprise et sa banque quand celle-ci n'est pas disponible (Berger *et al.*, 2005). Cette variable a donc les mêmes caractéristiques que la précédente. Il est intéressant de noter que cette variable est également utilisée comme proxy de l'information Hard émise par la firme (voir précédemment). Dans ce cas, elle est supposée négativement corrélée au relationnel bancaire. Cette contradiction peut expliquer les résultats que l'on retrouve (par exemple Harhoff et Körting, 1998, et Angelini *et al.*, 1998).

Ces mesures sont parfois couplées avec une mesure vue précédemment : *la quantité de contacts* (Scott, 2004 ; Uchida *et al.* 2012). Les auteurs expliquent qu'une relation de long terme ne suffit pas, il faut aussi prendre en compte le nombre de contacts entre les deux agents.

Ainsi, une relation de long terme et la multiplication des contacts entre la banque et la firme tendent à permettre l'accumulation d'information Soft par le chargé d'affaires, et à développer un relationnel bancaire.

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3.3.2.1.2 L'intensité de la relation

La seconde dimension est l'intensité de la relation entre la banque et la firme. Cette variable est principalement capturée par la nature du contact, le nombre de ventes additionnelles hors intermédiation financière auprès du client, le nombre de prêts octroyés par la banque et la part de crédit/de dépôt dans la banque.

Si le nombre d'interactions entre la banque et son client est important, certains auteurs (Cole *et al.*, 2004 ; Berger *et al.*, 2005 ; entre autres) arguent que la transmission d'information ne peut se faire qu'à travers un *contact personnel*. Plus le contact est personnel et plus la relation entre les deux agents est intense. Cela permet de transmettre plus d'information Soft et de développer un véritable relationnel.

La seconde mesure est *le nombre de produits*, hors intermédiation, que la banque a pu vendre à son client (Calomiris et Pornrojnangkool, 2009 ; Nakamura, 1993 ; Mester *et al.* 2007 ; entre autres). La banque est capable d'inférer de nouvelles informations sur la solvabilité de son client à travers d'autres produits financiers. Norden et Weber (2010) montrent par exemple que la gestion du compte courant peut être un bon indicateur.

Bodenhorn (2003) présente comme autre mesure possible le *nombre de prêts déjà octroyés par la banque*. Cette mesure capture indirectement l'ensemble de l'information que la banque a accumulée sur la firme grâce aux différents emprunts qu'elle a pu lui faire. De plus, elle capture également l'information provenant des remboursements précédents. Ainsi, elle est positivement corrélée à la mise en place d'un relationnel bancaire. Cette mesure a été reprise par Dereeper *et al.* (2016).

Enfin, la *part de crédit/de dépôt que la banque détient* dans le passif du client ou dans l'ensemble de ses dépôts est un autre indicateur de l'intensité de la relation. Plus cette part est importante, et plus la banque peut capter d'information sur son client. Cela favorise ainsi la mise en place d'un relationnel (Ogura, 2010 ; Presbitero et Zazzaro, 2011 ; Memmel *et al.* ; 2007)

3.3.2.1.3 L'exclusivité de la relation

L'exclusivité mesure le nombre de partenaires financiers avec lesquels la firme noue des relations. Comme expliqué précédemment, du point de vue de la banque, celle-ci sera plus encline à développer un relationnel si la firme n'a qu'un seul partenaire financier. Du point de vue de la firme, il est plus facile de ne transmettre son information qu'à un seul partenaire

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(Degryse et Van Cayseele, 2000 ; Lehmann et Neuberger, 2001 ; Degryse et Ongena, 2005). Ainsi, la principale mesure utilisée à ce niveau est le nombre de financeurs de la firme (Bonfim *et al.*, 2009 ; Montoriol-Garriga, 2005).

3.3.2.1.4 Limite des mesures

Cependant, ces mesures présentent des limites. Si ces paramètres favorisent le relationnel bancaire, rien ne dit que la structure organisationnelle de la banque permette au chargé d'affaires de faire usage de cette information Soft. Certaines banques peuvent présenter des politiques commerciales favorisant l'accumulation d'information Soft par ses chargés d'affaires (Uchida *et al.*, 2012), mais posséder un turnover de ceux-ci tel qu'il devient impossible de créer une relation stable (Hertzberg *et al.*, 2010).

Ce problème est également vrai pour les entreprises. Ce n'est pas parce qu'une firme possède une longue relation avec sa banque qu'elle émet obligatoirement de l'information Soft. D'autant plus que l'âge de la firme est fortement corrélé avec la quantité d'information Hard émise sur le marché (Berger *et al.*, 2005). Or cette dernière étant moins coûteuse que l'information Soft, les firmes plus anciennes sont plus incitées à utiliser l'information Hard.

3.3.2.2 La technologie de financement

Plus récemment, la littérature a vu apparaître des mesures de la technologie de financement (relationnel ou transactionnel) utilisée par la banque lors de l'octroi de crédit.

3.3.2.2.1 Mesures basées sur le contrat de crédit

Les premières mesures apparues sur la technologie de financement ont été construites en se basant principalement sur les caractéristiques du contrat de crédit. Le but de ces mesures est d'identifier les huit technologies de financement définies par Berger et Udell (2006) (cf. tableau 1).

Berger et Udell (1995) travaillent exclusivement sur les lignes de crédit, considérées par nature comme relationnelles, pour analyser les effets du financement relationnel par rapport à l'ensemble des financements transactionnels. Klapper (2006) se focalise sur l'affacturage pour analyser les effets du financement transactionnel. Cole *et al.* (2004) construisent des indicateurs

pour la plupart des technologies de financement : les lignes de crédit, l'équipement, le crédit-bail¹¹...

Enfin, Berger et Black (2011) développent une des mesures les plus complètes de la technologie de financement. Ils reconstruisent six des huit technologies de financement (leur base de données ne contenant que des données sur des crédits bancaires et aucun cas d'affacturage). Pour cela, ils croisent la nature des contrats (crédit-bail, présence de garantie, montant...), les caractéristiques de la firme et de son dirigeant (taille, leverage, cotation...) et de la banque (taille).

Ces mesures présentent l'intérêt d'être facilement reproductibles et ne nécessitent que peu d'information autre que le contrat (la structure de celui-ci suffisant le plus souvent à identifier plusieurs des technologies possibles). La principale critique repose sur le fait que ces indicateurs sont dichotomiques. Ils capturent la nature de la principale information utilisée lors de l'octroi de crédit mais pas l'intensité de celle-ci, ni si l'autre type d'information a été également utilisé.

3.3.2.2.2 Mesures basées sur la perception de la firme

Le second type de mesure de la technologie de financement est celui développé par Bartoli *et al.* (2013), Uchida *et al.* (2006) ou encore Cuculleli *et al.* (2016). Dans leurs articles, les auteurs utilisent des bases de données issues d'enquêtes auprès de PME¹². Ces enquêtes ont la particularité de contenir deux questions :

- La première concerne la nature de l'information que la firme privilégie dans sa relation avec la banque. Elle permet donc de savoir si la firme est émettrice d'information Hard ou Soft ;
- La seconde concerne la perception qu'a la firme de la gestion de l'information par la banque. Elle permet donc de mesurer si la banque est majoritairement relationnelle, transactionnelle ou un mix des deux.

Ces mesures présentent plusieurs intérêts : premièrement, elles ne sont pas dichotomiques. Elles capturent l'importance tant du relationnel que du transactionnel, sans supposer que les deux

¹¹ Il est intéressant de noter qu'en plus de ces indicateurs, Cole *et al.* (2004) utilisent d'autres mesures du relationnel bancaire, basées sur la durée, l'intensité et le nombre de partenaires financiers, pour appuyer leurs résultats.

¹² Respectivement le *Survey of Italian Manufacturing Firms* (SIMF), le *Management Survey of Corporate Finance Issues in the Kansai Area*, et la base *European Firms in Global Economy* (EFIGE)

technologies s'opposent¹³. Deuxièmement, ce sont des mesures de la perception de la firme du choix de relation de sa banque. Elles permettent donc d'analyser les choix de la firme en fonction de sa perception, et non forcément de la réalité.

Cependant, ces mesures sont impossibles à reproduire facilement hors des bases de données précitées. De plus, même s'il est intéressant d'avoir la perception de la firme, ces perceptions peuvent être faussées.

3.3.2.2.3 Mesures basées sur les données de la banque

Le dernier type mesure directement la nature de l'information utilisée lors de l'octroi de crédit. A notre connaissance, seuls Agarwal et Hauswald (2010) et Fischer (2000) créent ce type de mesure.

Dans le cas d'Agarwal et Hauswald (2010), les auteurs utilisent une base de données confidentielle de l'ensemble des demandes de crédits faites par les entreprises à une grosse banque américaine. Les auteurs ont eu accès à ce qu'ils appellent le « Proprietary score ». Ce score correspond à la note de crédit attribuée par la banque à la firme. Cette note tient compte non seulement de l'information publique, ou Hard, mais aussi de l'information privée, Soft, utilisée pour évaluer la firme. Les auteurs obtiennent leur mesure de l'information Soft utilisée de la façon suivante : dans un premier temps, ils régressent ce « Proprietary score » sur deux scores mesurant l'ensemble de l'information publique disponible sur la firme (un score sur la firme et un score sur le dirigeant). Puis, ils utilisent le résidu pour capturer la quantité d'information Soft utilisée par la banque.

Dans le cas de Fischer (2000), l'auteur a accès à une base de données confidentielle où la banque liste les informations demandées pour la décision d'octroi de crédit (projection de flux, états financiers sur les dernières années...). A partir de cette liste, l'auteur est capable de créer une liste de la quantité d'information Soft et Hard utilisée par la banque.

L'intérêt de ces mesures est qu'elles sont très précises sur la nature et la quantité d'information utilisée par la banque. Le défaut est qu'elles sont difficilement reproductibles. A notre connaissance, il n'existe aucune autre base de données contenant ces informations, et les deux bases citées sont confidentielles.

¹³ Bartoli *et al.* (2013) démontrent d'ailleurs que ces deux technologies de financement sont complémentaires.

3.3.3 Synthèse

Le tableau ci-dessous synthétise l'ensemble des mesures retrouvées au sein de la littérature empirique sur le relationnel bancaire :

Tableau 2 : synthèse des différentes mesures du relationnel bancaire

Critères de classification	Variables	Impact sur la mise en place du relationnel
<i>Déterminants du relationnel bancaire</i>		
Caractéristiques de la firme	Âge	-
	Taille	-
	Niveau d'actif intangible/de R&D	+
	Niveau d'éducation/d'expertise du dirigeant	+
	Niveau d'information Hard émise	-
Caractéristiques de la banque	Taille	-
	Statut	-
	Distance fonctionnelle/organisationnelle	-
<i>Composantes du relationnel bancaire</i>		
Durée	Age de la firme	+
	Durée de la relation	+
	Nombre de contacts	+
Intensité	Type de contact	+
	Nombre de produits vendus	+
	Nombre de prêts déjà octroyés par la banque	+
	Part de crédit/dépôts détenue par la banque	+
Exclusivité	Nombre de financeurs	-
Technologie de financement	Indice cherchant à capturer l'information principalement utilisée lors de l'octroi	Variable

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En résumé, cette thèse est centrée autour du financement relationnel bancaire, et plus précisément d'une de ses composantes : la technologie de financement relationnel. Pour cela, elle sera divisée en trois chapitres. Le premier chapitre traitera, dans un premier temps, la question de la mesure de la technologie de financement relationnel. Puis, nous utiliserons cette mesure pour amener une réponse à un débat existant : l'impact de la compétition bancaire sur la mise en place de cette technologie de financement. Le second chapitre traitera de l'utilisation de la technologie relationnelle par les minorités. Enfin, le troisième chapitre traitera de la question de la substitution d'une technologie de financement relationnel déficiente. L'ensemble de nos trois chapitres suivent une méthodologie similaire : dans un premier temps, nous développerons la question de recherche et sa place au sein de la littérature existante. Puis, nous détaillerons la méthodologie de recherche empirique développé pour répondre à la question. Enfin, les résultats seront présentés et discutés.

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Chapter 1:
Impact of banking competition on the use of soft
information

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Over the past 20 years, scholars have discussed the impact of banking competition on the choice between transactional and relationship lending technologies extensively, and both empirically and theoretically, but no resolution has emerged. To address these questions, this article uses a new measure of relationship lending that accounts for the actual level of soft information that banks use in their loan pricing. With this new measure, the analysis reveals that banks prefer to implement relationship lending technology when competition is weak. In addition and in accordance with extant theoretical conclusions, the shape of the relationship between competition and relationship banking is nonlinear and concave.

1 Introduction

To price the credit sought by firms, banks must estimate the quality of each applicant's project accurately. They use different sources of information: accounting and financial data, credit history, firm characteristics, potential competitors, abilities of managers and so on. As Stein (2002) suggests, this information can be split into two parts. "Soft information" corresponds to qualitative details, such as the business skills or honesty of the firm manager. "Hard information" instead encompasses all quantitative data, such as accounting and financial data and credit scores. Using these two kinds of information, Berger and Udell (2006) distinguish two main categories of lending technology:

- *Transaction-based lending technology*, primarily based on borrowers' hard information.
- *Relationship lending technology*, primarily based on borrowers' soft information.

As Elsas (2005) notes, the choice between these two technologies depends on the characteristics of the borrowers, the bank and the market. Evidence clearly indicates that small and medium-sized enterprises (SME) and non-hierarchical banks benefit more from the relationship lending technology (Berger and Udell, 1995; Berger et al., 2005; Berger and Udell, 2006), but the impact of banking competition on the choice between transactional and relationship lending technologies remains uncertain. Mayer (1988) proposes an initial answer, by arguing that competition and relationship banking cannot coexist, because firms can easily switch banks, so banks have no interest in developing relationships. Petersen and Rajan (1995) adopt a similar view, then show theoretically and empirically that a bank in a competitive sector restrains its credit and uses only transactional lending. Ogura (2010, 2012) and Fischer (2000) confirm this discovery empirically.

In contrast, with their theoretical model, Boot and Thakor (2000) show that the greater the competition between banks, the more banks engage in relationship lending. Their result reflects an informational advantage, such that accurate and private information about borrowers provides good protection against banking competition. Dell'Ariccia and Marquez (2004) go a step further and demonstrate that when competition increases, banks should extend their lending activities to include more "opaque" firms (i.e., the flight to captivity) (see also Hauswald and Marquez, 2006). Schmeits (2005) also points out that competition is necessary to initiate relationship lending, because without competition, banks use the flexibility inherent in these contracts to demand high rates (i.e., holdup problem). Bonfim, Dai and Franco (2009),

Montoriol-Garriga (2005), Black and Strahan (2002) and Memmel, Schmieder and Stein (2008) empirically validate these theoretical results.

How can we explain these discrepancies in empirical results? A first explanation is based on a non-monotonic approach to the relationship between banking competition and relationship lending. Even if relationship lending provides some protection against banking competition, this protection might weaken when competition increases: More lenders implies lower monopoly rents. The costs of achieving relationship lending are fixed though, so there is a threshold for competition, beyond which building a relationship is unprofitable and banks prefer to offer transactional lending. The relationship between competition and relationships then might not be monotonic but rather concave, prompting transactional lending when competition is low, relationship lending when it is medium and then transactional lending again when competition is high (Anand and Galetovic, 2006; Dinç, 2000; Yafeh and Yosha, 2001). Although Elsas (2005) and Degryse and Ongena (2007) empirically confirm this nonlinear relationship, they observe a convex, rather than concave, form. Finally, this nonlinear relation could be apparent rather than actual. As Presbitero and Zazzaro (2011) show, the nonlinear relationship between banking competition and the supply of relationship lending disappears when bank size is taken into account. Greater concentration causes banks to refocus on their core business, namely, relationship lending for small banks and transactional lending for large ones.

Another explanation relies instead on the measures of relationship lending that prior studies adopt. First, studies vary in how they measure relationship lending (Table A1 in the Appendix outlines the relationship proxies used in prior research). For example, Petersen and Rajan (1995) use firm age, whereas Bonfim *et al.* (2009) use the number of banks. These differences could affect the outcomes. The conflicting results obtained by Montoriol-Garriga (2005) and Petersen and Rajan (1995) illustrate this problem succinctly: Both use the same database (NSSBF 1988), but the former measures relationship lending according to the number of banks, whereas the latter relies on the age of the company. Second, measures of relationship lending may be problematic. For example, the size of a bank seems like an ambiguous proxy, and Uchida *et al.* (2012, p. 97) even show that though “loan officers at small banks produce more soft information than a large bank, large banks have the equivalent potential to underwrite relationship loan.”

Finally, most empirical studies distinguish relationship and transactional lending using what may be an overly simplistic categorization, with the assumption that the two technologies are mutually exclusive (e.g., Petersen and Rajan, 1995; Berger and Udell, 2004). However, Uchida *et al.* (2006) and Bartoli *et al.* (2013) show that banks frequently rely on multiple lending technologies banks to finance SMEs. Assessing lending technologies without considering the potential complementarity among them thus might bias some results and explain the conflicting conclusions reached thus far.

The main goal of this article is to address the impact of banking competition on lending technologies by using a new measure of the relationship lending technology that captures the amount of soft information that the bank uses to price the loans requested by firms. We do not attempt to include all dimensions of relationship lending but instead acknowledge that banks and firms implement this form of financing for two main reasons, beyond increasing the information held by the former about the latter. First, some firms seek a protection against troubled times. With a longstanding relationship, a bank can support its customer, even during bad periods (e.g., by charging lower interest rates), and in return, the customer compensates for the loss when its situation improves (Sharpe, 1990). Second, such relationships help banks cross-sell other products or services to borrowers (Santikian, 2014).

To measure relationship lending technology according to the amount of soft information used by the banks in the loan process, we start at the same point as Cerquero *et al.* (2011), who seek to explain the dispersion of loan rates offered by banks to small enterprises. In a frictionless world, such dispersion should not exist, and similar firms obtain similar rates. In reality though, “frictions in the credit market enable banks to price in a discretionary manner” (Cerquero *et al.*, 2011, p. 503). The greater these frictions, the less standardized is the lending technology used by a bank (loan officer). To go a step further, we seek to distinguish the use of soft information by the bank from other frictions in the credit market. Thereby we can build a measure of the use of soft information by banks, according to the level of standardization in the lending process. Moreover, our methodology disentangles transactional-based and relationship lending technologies without assuming that they are mutually exclusive. Rajan *et al.* (2015) propose a similar methodology in a different context, in that they study the behavioral changes exhibited by lenders in response to the boom in securitized subprime mortgages. With securitization, soft information becomes less valuable than hard information, so a lender’s incentive to produce the former information is weak, and interest rates become worse predictors

of default. However, Rajan *et al.* (2015) do not explicitly measure relationship lending as we do; instead, they regress loan interest rates (mortgages) on some indicators of hard information to deduce (using R-squares) the level of hard information that the lender uses to price the loan.

With our measure built, we next can turn to the issue of the impact of banking competition on lending technologies and, more precisely, on the use of soft information by the bank when it prices a loan. We show that banks prefer to implement relationship lending technologies when competition is weak. With regard to the shape of the relationship between competition and lending technology, we also find, in accordance with extant theoretical conclusions, that the relationship is nonlinear and concave. Moreover, our indicator of relationship lending technology is coherent with Agarwal and Hauswald's (2010) conclusion about the location-specific nature of soft information: The more closed a loan applicant to its bank, the more soft information the bank uses in its loan pricing.

In Section 2, we describe the method we implemented to build our proxy for relationship banking and the econometric model that we use to measure the impact of banking competition on relationship lending. After we describe the database and variables in Section 3, we present the model results and the impact of competition in Section 4. Section 5 contains the robustness tests, and Section 6 reports on a panel analysis based on two databases (NSSBF 98 and SSBF 03). Finally, Section 7 concludes.

2 Models

2.1 *Measure of lending technologies*

To build our measure of relationship lending technology, we start with the methodology proposed by Cerquiere *et al.* (2011), which we introduced previously, and then go a step further. In particular, we split the non-standardized technology into two parts. The first is a pure discretionary technology, such as when the loan officer's judgment might be affected by levels of bargaining power (for the bank or firm), experience, the gender of the applicant and so on. The second part is relationship lending, which accounts for the effects of this kind of financing on the rate charged by the bank. Our goal is to capture the amount of soft information the bank uses to price some loan, so we distinguish seeking better information from the other two central relationship lending objectives that we described in the introduction. Accordingly, our starting point is the following loan pricing equation:

$$\text{Spread}_i = a + b \times \text{Hard}_i + c \times \text{Soft}_i + d \times \text{Disc}_i + e \times \text{OtherRel}_i + f \times \text{Control}_i + \varepsilon_i. (1)$$

In this equation, the interest rate (variable “Spread”) charged by a bank depends on the level of hard and soft information used by bank to value the quality of the firm’s project (variables “Hard” and “Soft”). But some discretion can add noise to the loan-pricing process (variable “Disc”). The establishment of relationship lending for reasons other than collecting soft information also affects the interest spread (variable “OtherRel”). Finally, the spread depends on contract characteristics, some macroeconomic variables and firm characteristics (variable “Control”). Because soft information by definition is non-quantifiable, it is not available in databases (e.g., SSBF 2003). We only have access to hard information, discretionary behavior and contract variables. Therefore, we use the following equation:

$$\text{Spread}_i = a + b \times \text{Hard}_i + c \times \text{Disc}_i + d \times \text{OtherRel}_i + e \times \text{Control}_i + \varepsilon'_i, (2)$$

where:

$$\varepsilon'_i = \text{Soft}_i + \varepsilon_i. (3)$$

Equation 2 is the heart of our measure of relationship lending. Suppose a firm obtains a loan from a bank that resorts to mainly hard information in its risk assessment. In this case, the previous regression presents a weak error (small ε'_i). In contrast, if the bank uses a great deal of soft information, the error will be high. We apply this idea to our sample. First, we regress the spread on variables measuring hard information (vector “Hard_i”), discretionary behavior, contract variables and some other control variables. Second, we sort out all individual loans with high residuals. Because the residuals capture the quantity of soft information that banks take into account, we define our first measure of relationship lending technology as follows:

- SOFT1: Continuous variable corresponding to the square of the residuals.

To check the results we obtain with this continuous variable, we also build three binary measures:

- SOFT2: Dummy that takes a value of 1 when the absolute value of the residual of observation “i” is greater than 1 times the standard deviation of the regression’s residuals.
- SOFT3: Dummy that takes a value of 1.1 when the absolute value of the residual of the observation “i” is greater than 1.1 times the standard deviation of the regression’s residuals.

- SOFT4: Dummy that takes a value of 1.2 when the absolute value of the residual of the observation “i” is greater than 1.2 times the standard deviation of the regression’s residuals.

Our methodology differs from that used by Cerquiero *et al.* (2011), in that we do not use a regression with multiplicative heteroskedasticity (Harvey, 1976). This methodology may seem appropriate, because it allows residual variance to vary across different observations. But even if the variance equation in the heteroskedastic regression can measure the impact of some variables on residual variance, it does not provide an explicit measure of relationship banking.

2.2 *Relationship lending technology and competition banking*

The second, main step addresses the impact of banking competition on lending technologies. We test the following equation:

$$Soft_i = a + b.Comp_i + c.Relation_i + \varepsilon_i. (4)$$

The variable $Soft_i$ corresponds to our one of the four proxies of relational lending technologies (SOFT1, SOFT2, SOFT3, SOFT4) from the previous section. The vector $Comp_i$ measures banking competition. In line with previous research (e.g., Degryse and Ongena, 2007; Ogura, 2010; Petersen and Rajan, 1995), we use the Herfindahl-Hirschman index¹⁴ (HHI) for the commercial bank deposits of the metropolitan statistical area (MSA) or county¹⁵ where the firm's headquarters are located. Finally, $Relation_i$ is a vector of control variables related to relationship lending.

3 Data

3.1 *The database*

The 2003 Survey of Small Business Finances (SSBF), conducted by the Board of Governors of the Federal Reserve System, provides our data. The database contains information on 4240 SMEs, defined here as firms with fewer than 500 full-time-equivalent employees. For these firms, the detailed information includes balance sheets and income statements (e.g., liabilities, assets, income), firms’ and owners’ characteristics and relationships with financial service suppliers for a broad set of products and services (Mach and Wolken, 2006). This database

¹⁴ This index equals the sum of the squared market shares times 10,000.

¹⁵ In the United States, there are 3,144 counties and county equivalents and 381 MSAs.

often supports research on relationship banking (e.g., Berger and Udell, 1994; Petersen and Rajan, 1994), though it contains sparse information about banks' characteristics. Beyond the advantage of being accessible for free, this database is interesting for two main reasons. First, it contains a great deal of information about SMEs, which suffer substantial information asymmetry and for which the benefits of relationship lending are thus the greatest. Second, the survey underlying the database is renewed regularly, so we can compare our model and results over time.

Because accounting data in SSBF 2003 are available only for 2003, we only retain firms that received credit during 2003 or 2004. In the sample of 1502 firms that negotiated credit in 2003 or 2004, we removed 76 finance, insurance and real estate firms (so-called FIRE firms), due to their specificities, as well as 185 firms that did not obtain loans from commercial banks. Of the remaining 1241 firms, only 688 provided all the needed variables (e.g., spread, credit score, maturity). Finally, we excluded 12 firms that had been in business for less than two years, because establishing a strong relationship takes time, and it is difficult for very young firms to implement such a relationship.

With the remaining 676 observations, we built a data set with five types of variables: firm characteristics, bank characteristics, loan characteristics, bank–firm relationships and market characteristics. Table A2 in the Appendix details the data set.

3.2 Variables used to measure relationship lending

Recall that we obtain a proxy of relationship lending from Equation 2:

$$Spread_i = a + b \times Hard_i + c \times Disc_i + d \times OtherRel_i + e \times Control_i + \varepsilon'_i. (2)$$

The dependent variable is based on the spread, defined as the percentage over the index of the loan. Banking competition clearly influences the spread (Degryse and Ongena, 2005). We need to control for this influence without using banking concentration, a variable that is central to our regressions (Equations 4) for the impact of banking competition on lending technologies. To resolve this issue, we decided to subtract the spread of a firm by the mean spread of the zone of competitiveness in which the firm is located. Our dependent variable (SPREAD2) is the result. Yet we also recognize that this subtraction could affect our measure of relationship banking,¹⁶ such as if the mean spread of the zone of competitiveness were correlated with soft

¹⁶ We thank Hans Degryse, who noted this potential problem during a 3L workshop.

information. To test this possibility, we regressed the mean spread of the zone of competitiveness on two variables (often used as proxies of soft information):

- PERSONAL: Dummy equal to 1 if the most frequent method of conducting business with the bank offering the credit is personal.
- DREL: Dummy that takes a value of 1 if the firm has only one bank and if the length of the relationship with this bank at the time of application is at least two years. This variable integrates two classic dimensions that characterize a strong relationship between banks and firms: duration and exclusivity.

Neither of these variables correlates with our variable of interest (Table A3).

Next, we split our vector of hard information into five variables:¹⁷ the firm's rating on Dun & Bradstreet Rank Credit Score (D&B); the firm's leverage (LEVERAGE), as measure of its creditworthiness (D'Auria *et al.*, 1999); the owner's experience, which offers a proxy of the owner's rating (EXP); the previous firm's bankruptcy (BANKRUPTCY); and an interaction (dummy) that combines D&B \times DSIZE to control for ratings according to firm size.

As we noted previously, the "Disc" vector corresponds to discretionary variables that are not formally linked to the relationship lending. It comprises four subgroups of variables. The first group contains variables that capture the reason the firm applied for credit (CAPT1, CAPT2, NOBANK, CHANGEBK); a second group of variables pertains to firm manager characteristics, including gender (FEMALE) and ethnicity (WHITE, BLACK, HISP, ASIAN); the third group captures the influence of the size and the structure of the firm (SIZE, OWNER AGE, CORPORATE, SUBS); and the fourth features bank characteristics (BHC).

Our strategy for separating the non-standardized technology into two parts (pure discretionary and relationship banking) becomes an issue for the variable that measures the physical distance between the firm and its main bank office (DISTANCE). On the one hand, the distance between a firm and its bank increases information asymmetry and thus implies more noise in loan pricing (Cerquero *et al.*, 2011). On the other hand, this variable appears connected to relationship lending, such that a shorter physical distance might facilitate soft information gathering by the loan officer and help establish a lending relationship (Berger *et al.*, 2005). We decided to follow Cerquero *et al.* (2011) and integrate DISTANCE into the "Disc" vector.

¹⁷ We also test with the square of all hard variables; the results remain the same.

As explained previously, we also control for the other type of relationship lending, for which we include seven dummy variables that reflect why the firm applied for credit from this institution: PRIORRL, LGPOLICIES, PREVLOAN, PDTQ, PDTA1, PDTA2 and PDTA3.

Finally, we include several groups of control variables. Loan characteristics might explain some variability in the spread, such as loan maturity (MATURITY), its amount (AMOUNT), its type (CREDIT LINE, LEASING CAPITAL, MVE LOAN), potential partial credit rationing (RATIONING) and the amount of guarantee required (GARANTY). We also include the cost of the loan (COST) to the applicant, because sometimes banks decide to offer a low spread but compensate for it with high fees. We control for the value of the original index¹⁸ to which the credit is tied (INDEX1, INDEX2). A second set of control variables integrates industry specifications (five dummies), the year (one dummy) and the area, as represented by two sets of variables: eighteen dummies (one by geographical area) and URBAN (equal to 1 if the firm is located in a rural county). Finally, similar to Ogura (2010), we include the default premium (DEFAULT PREM) and term premium (TERM PREM) of the market when credit is applied. For a complete description of each variable, see Table A2.

3.3 Variables in the analysis of banking competition

To study the impact of banking competition on the choice of lending technology, we test:

$$Soft_i = a + b.Conc_i + c.Relation_i + \varepsilon_i. (4)$$

The dependent variable is one of the four proxies of relationship lending (SOFT1, SOFT2, SOFT3, SOFT4). As noted previously, we measure banking competition using the Herfindahl-Hirschman index (HHI) of banks' market shares. Because the SSBF 2003 divides the concentration variable by 3, we created two dummies: HHI1, equal to 1 if $HHI < 1000$, and HHI2, equal to 1 if $1800 \leq HHI$. The vector Comp integrates these two dummies. The "Relation" control variables refer to relationship lending (DREL, PERSONAL) (Table A2).

¹⁸ In SSBF, interest rates can be tied to the prime rate, LIBOR or some other index.

4 Results

4.1 *Measure of relationship lending*

Table A4 in the Appendix presents the results of the spread equation (Equation 2). In all regressions, we winsorize all our variables at 1%, to avoid potentially spurious outliers.¹⁹ For the hard variable results, as expected, the coefficient of the D&B (rating) variable is negative and significant, in support of our intuition that a higher rating means a lower spread. In addition, LEVERAGE is negative and significant. Firms that choose their bank depending on their lending policies have a better spread than others.

Regarding the discretion variables, captive firms must pay a higher spread than others, and both HISP and WHITE are (highly) significant, such that the spread is higher if the manager is Hispanic or White, which suggests a surprising outcome. A firm in an urban area also has a higher spread than a firm in a rural zone. Regarding loan characteristics, we recognize a potential endogeneity problem between these variables and our dependent variable (SPREAD2), so we do not interpret these results. We do not rely on either measure or interpret the possible relation of causality between these variables though, so even if the problem is relevant, endogeneity does not affect our measures of the management of soft information (Introduction to Econometrics, 3/e Stock and Watson).

Following the method we described in Section 2.1, we use residuals from Equation 3 to build our four indicators of relationship lending. Specifically, we determine our continuous variable (SOFT1) and the three binary proxies (SOFT2, SOFT3, SOFT4) when the absolute value of the residual of a given observation is greater than (respectively) 1, 1.1 or 1.2 times the standard deviation of the regression's residuals. Table 1 displays the results of each sort. For example, in the case of SOFT2, there are 151 observations (22% of our sample) for which the bank mainly used soft information to price the loan.

Table 1: Three binary proxies of relationship lending

Dummy variable	Number of observations	Percentage in the sample
SOFT2 ($>\sigma$)	151	22%
SOFT3 ($>1.1\sigma$)	128	19%
SOFT4 ($>1.2\sigma$)	111	16%

¹⁹ We also conduct the tests without any winsorization, and the results remain the same. These results are available on request.

4.2 Concentration and relationship lending

Table A5 in the Appendix reports the results of our analysis (Equation 4), related to the impact of concentration on relationship lending. The first column corresponds to our continuous proxy (SOFT1), and the three others reflect our binary proxies of relationship lending (SOFT2, SOFT3, SOFT4). From the continuous proxy SOFT1, we determine that HHI1 is negative and significant, such that low concentration in the banking sector diminishes the probability that banks use soft information. Therefore, our results validate Petersen and Rajan's (1995) conclusions, rather than those proposed by Boot and Thakor (2000), regarding the impact of banking competition on the lending technologies that banks implement. For the dummy variables, we find that HHI1 is significant and negative for SOFT3 and SOFT4 but not for SOFT2. Perhaps banking concentration affects the important use of soft information by the bank (SOFT 3 and 4) rather than its mean use (SOFT2).

If HHI1 is almost always negative and significant, HHI2 is never significant. This result indicates that the link between the use of soft information and banking market concentration is nonlinear. To confirm this result, we test Equation 4 after replacing our Conc_i vector variables with the HHI and its square (see Table A6). The HHI and HHI^2 are, respectively, positively and negatively significant, a finding that empirically validates the nonlinear link. That is, banks prefer transactional lending technology and the use of hard information when concentration is high but relationship lending technology and the use of soft information when it decreases; this preference seems to stagnate as concentration decreases again. This result supports findings by Dinç (2000), Anand and Galetovic (2006) and Yafeh and Yosha (2001).

Next, regarding the variables that characterize bank–firm relationships, we note that the personal contact between the firm and the bank does not seem to affect the use of soft information. The variable measuring the strength and duration of this relationship (DREL) reveals a positive and significant result though, in support of the accuracy of our approach.

5 Panel analysis

5.1 Panel sample

In this section, we construct a new sample by merging the 1998 NSSBF (224 observations of credit provided from 1996 to 1998) and the 2003 SSBF (676 observations of credit provided

from 2003 to 2004). We thus obtain a new sample of 900 observations of credit provisions from 1996 to 2004 but use the same variables, with the exception of the dummy BHC, which is absent from the 1998 NSSBF. Table A2 contains the statistical description of the 1998 NSSBF.

5.2 Methodology

We follow the same methodology and first run our spread equation,²⁰

$$Spread_i = a + b \times Hard_i + c \times Disc_i + d \times Control_i + \varepsilon_i'$$

Then we use the residuals to construct our continuous variable (SOFT1) and the three dummy variables (SOFT2, SOFT3, SOFT4) for use in the second equation:

$$Soft_i = a + b \cdot Conc_i + c \cdot Relation_i + \varepsilon_i.$$

5.3 Results

Table A7 in the Appendix displays the results for our first equation. As before, we do not interpret the loan characteristic variables, due to the endogeneity with our dependent variable. Table 2 details the number of soft variables further, according to this analysis.

Table 2: Three binary proxies of relationship lending in the panel analysis

Dummy variable	Number of observations	Percentage in the sample
SOFT2 ($>\sigma$)	188	21%
SOFT3 ($>1.1\sigma$)	156	17%
SOFT4 ($>1.2\sigma$)	134	15%

Using these variables in our second equation, we obtain results for the linear impact of competition on the use of soft information (Table A8 in the Appendix). As these results show, HHI1 always exerts a negative, highly significant impact. Moreover, HHI2 is positive and significant, in support of our previous results. A high level of concentration leads to a preference for the use of soft information. Moreover, the results seem to indicate that concentration exerts a linear impact on the use of soft information, as supported by the evidence in Table A9. With a dummy variable that equals 1 if the credit was granted in 2003 rather than 1998 (Y2003), we estimate the same regression, splitting the impact of HHI1 and HHI2 according to this dummy.

²⁰ Our dependent variable is still the spread of a firm minus the mean spread of the zone of competitiveness where the firm is located. We confirm and ensure that the mean spread of the zone of competitiveness is not correlated with any soft variable.

Whether in 1998 or 2003, the impact of concentration on the use of soft information by the bank remains the same: Low (high) concentration leads to a decrease (increase) in the use of soft information (Table A10). Moreover, the nonlinearity is only apparent in 2003 (Table A11). Finally and interestingly, we note that the variable DREL is always positive and significant, which confirms the appropriateness of our measure.

6 Conclusion

Questions about the impact of banking competition on the choice between transaction-based and relationship-based technology have persisted for decades (both empirically and theoretically), without any clear resolution. With this study, we seek to address these questions by using a new measure of relationship lending technology. Starting from the methodology developed by Cerquero *et al.* (2011), we build an accurate measure of lending relationship technology that reflects the actual level of soft information a bank uses at the time of loan pricing, as precisely as possible. This new approach permits us to conclude that banks prefer to implement relationship lending technology when competition is weak, in support of Petersen and Rajan's (1995) findings. We also can specify the shape of the relationship between competition and relationship banking; in accordance with theoretical predictions from Dinç (2000), Anand and Galetovic (2006) and Yafeh and Yosha (2001), we find that the relationship between competition and relationship banking is nonlinear and concave.

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Table A1: Measures of relationship banking in prior literature

Theoretical studies	Empirical studies	Measure of relationship banking
Petersen and Rajan (1995)	Petersen and Rajan (1995)	Firm age
	Fischer (2000)	Quantity and type of information issued by firms
	Ogura (2010)	Inside bank (length of relationship and amount deposited in checking account)
	Ogura (2012)	Bank size
Boot and Thakor (2000)	Bonfim <i>et al.</i> (2009)	Number of banks
	Montoriol-Garriga (2005)	Number of banks
	Black and Strahan (2002)	Creation of new business
	Memmel, Schmieder and Stein (2007)	Length and strength of relation
Nonlinear relation	Elsas (2005)	Status of bank: main bank or not
	Presbitero and Zazzaro (2011)	Main bank's share of credit supply greater than one-third
	Degryse and Ongena (2007)	Length of relationship and status of bank (main or not)

Table A2

Descriptive statistics

This table contains the means and standard deviations of each variable for a sample of loans in the 2003 SSBF and 1998 NSSBF.

Variables	Description	Mean		Std. Dev.	
		2003	1998	2003	1998
<i>Firm characteristics</i>					
SIZE	Natural logarithm of total assets	14.11	13.21	2.07	2.38
D&B (Rating)	Dun & Bradstreet Rank Credit Score: 1 = most risky; 6 = least risky	4.03	2.99	1.45	1.16
LEVERAGE	Log(Total debts / Total assets)	1.14	2.37	5.39	20.04
EXP (owner experience)	Weighted average experience of owners (year)	23.90	19.85	10.56	10.26
SIC1 (Construction)	1 if Construction industry	13.28%	12.05%	33.97%	32.63%
SIC2 (Manufacturing)	1 if Manufacturing industry	21.04%	17.86%	40.79%	38.38%
SIC3 (Wholesale)	1 if Wholesale industry	11.94%	12.95%	32.45%	33.65%
SIC4 (Retail)	1 if Retail Trade industry	17.01%	19.64%	37.60%	39.82%
SIC5 (Services)	1 if Services industry	32.09%	30.80%	46.72%	46.27%
SUBS (S-Corporation)	1 if the firm is a S-corporation	46.71%	39.29%	49.93%	48.95%
CORP (C-Corporation)	1 if the firm is a C-corporation	36.42%	35.27%	48.16%	47.89%
BANKRUPTCY	1 if the main owner has declared bankruptcy within the past 7 years	0.29%	0%	5.46%	0%
FIRM DEFAULT	1 if firm has been 60 or more days delinquent on business obligations within past 3 years	18.06%	81.69%	38.49%	38.76%
JUDGEMENTS	1 if at least a judgment has been rendered against the firm within the past 3 years	2.99%	3.12%	17.03%	17.44%
FEMALE	1 if the manager is a female	12.09%	18.75%	32.62%	39.11%
WHITE	1 if the manager is white	82.69%	82.14%	37.87%	38.38%
BLACK	1 if the manager is black	0.45%	5.36%	6.68%	22.57%
HISP	1 if the manager is Hispanic	2.54%	4.02%	15.74%	19.68%
ASIAN	1 if the manager is Asian	3.58%	8.48%	18.59%	27.92%
AGE	Age of firm in years	3.99	3.90	0.18	0.21
<i>Bank characteristics</i>					
BHC	1 if the bank is affiliated with a holding	87.61%	NC	32.97%	NC

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Loan characteristics

SPREAD	Percentage over index of the loan	1.305	2.18	1.456	2.37
SPREAD2	Percentage over index of the loan – mean spread of the zone of competitiveness of the firm	0	0	1.44	2.349
MATURITY	Maturity of the loan (months)	31.01	48.53	45.68	67.39
AMOUNT	Natural logarithm of the amount of the loan/credit granted/1000	5.93	5.10	1.81	1.82
INDEX1	1 if credit is tied to it, 0 otherwise	87.01%	100%	33.63%	100%
INDEX2	1 if credit is tied to it, 0 otherwise	7.91%	0%	27.01%	0%
RATIONING	Amount of credit granted/amount of credit applied	1.07	0.98	0.84	0.21
GARANTY (account_garanty)	1 if inventory or accounts receivable were required as collateral	37.16%	29.46%	48.36%	45.69%
COST (cost_loan)	(Total dollar amount of fees associated with obtaining the credit/Total amount of the credit granted) × 100 (in %)	41.01%	2.20%	102.03%	16.26%
YEAR_2003	1 if the loan is made in 2003, 0 otherwise	29.85%	-	45.80%	-
YEAR_1997	1 if the loan is made in 1997, 0 otherwise	-	14.73%	-	35.52%
YEAR_1998	1 if the loan is made in 1998, 0 otherwise	-	31.25%	-	46.46%
MVE LOAN	1 if the loan is a mortgage, a vehicle loan or an equipment loan, 0 otherwise	7.61%	1.78%	26.54%	13.28%
CREDIT LINE	1 if the loan is a new line of credit or a line of credit renewal, 0 otherwise	54.17%	10.27%	49.86%	30.42%
LEASING CAPITAL	1 if the loan is a capital lease, 0 otherwise	0.15%	0%	3.86%	0%
PRIORRL	1 if, among all the reasons quoted by the firm in the question “why apply for credit from this institution?” the firm answers: Long-term relationship/ongoing relationship/prior relationship, 0 otherwise	39.64%	25%	48.95%	43.40%
LGPOLICIES	1 if the firm answers: Lending policies or terms, 0 otherwise	4.44%	2.68%	20.61%	16.18%
PREVLOAN	1 if the firm answers: Previous loan, loan when starting business, 0 otherwise	4.29%	0.89%	20.28%	9.43%
PDTQ	1 if the firm answers: Quality of service or of services, 0 otherwise	1.48%	3.57%	9.38%	18.60%
PDTA1	1 if the firm answers: Convenience/ease of use, 0 otherwise	5.32%	5.80%	22.47%	23.43%
PDTA2	1 if the firm answers: One-stop shopping, able to obtain multiple services at same institution, 0 otherwise	1.33%	0%	11.47%	0%
PDTA3	1 if the firm answers: Service availability (including credit card processing availability), 0 otherwise	2.07%	1.33%	14.25%	11.52%
CAPT1	1 if the firm answers: Seller referral (e.g. car dealer suggested loan company), 0 otherwise	0.15%	0%	3.84%	0%
CAPT2	1 if the firm answers: Captive finance (e.g. used financial institution owned by seller), 0 otherwise	0.30%	0%	5.43%	0%

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NOBANK	1 if the firm answers: Credit needed, no other response given, 0 otherwise	4.29%	0%	20.29%	0%
CHANGEBK	1 if the firm answers: Dissatisfaction with previous institution, 0 otherwise	0.89%	2.68%	9.38%	16.18%
<i>Bank-firm relation</i>					
DISTANCE	Distance of the firm to its bank (in miles)	25.68	112.40	126.25	318.68
DREL (Relationship dummy)	1 if the firm has only one bank and if the length of relationship with this bank at time of application is at minimum 2 years (in %)	7.16%	26.79%	25.81%	44.38%
PERSONAL	1 if the most frequent method of conducting business with the bank which made the credit was in person	63.73%	42.86%	48.11%	49.60%
<i>Market characteristics</i>					
DEFAULT PREMIUM	The market yield on US Treasury securities of the closest term of the most recent loan minus the market yield on US Treasury securities at 3-month constant Treasury	0.91	0.46	0.88	0.39
TERM PREMIUM	Moody's yield on BAA seasoned corporate bond minus the market yield on US Treasury securities at 10-year constant maturity (in %).	2.28	2.05	0.296	0.35
HHI	Banking Market Concentration 2003 – 100% bank deposits. Variable equal to 1 if $0 < \text{Herfindahl} < 1000$; 2 if $1000 \leq \text{Herfindahl} < 1800$; 3 if $1800 \leq \text{Herfindahl}$	2.378	2.51	0.603	0.59
HHI1	1 if commercial bank deposit Herfindahl index of MSA/county where firm's headquarters is located is $\text{HHI} < 1000$ (low concentrated) (in %)	6.42%	4.91%	24.53%	21.66%
HHI2	1 if commercial bank deposit Herfindahl index of MSA/county where firm's headquarters is located is $\text{HHI} > 1800$ (high concentrated) (in %)	44.18%	55.80%	49.70%	49.77%
URBAN	1 if the firm located in rural county (cf. MSA)	17.61%	0%	38.12%	0%
Number of observations		676	224		

Table A3

Determinants of mean spread in SSBF 2003

This regression shows the impact of soft variables on the dependent variable of the mean spread of the zone of competitiveness (MEANSPREAD). The regression is robust to heteroskedasticity. We do not winsorize the variables. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	Meanspread
DREL	-0.035 [0.306]
PERSONAL	0.008 [0.644]
Constant	1.301 *** [0.000]
Observations	676
R-squared	0.006
Adjusted R-squared	0.003

Table A4

Determinants of spread in SSBF 2003, Equation 2 (winsorized at 1%)

This regression shows the impact of the rating on the spread of the last approved credit. Our dependent variable is SPREAD2, which is the spread minus the mean spread of the zone of competitiveness. We also add control variables for the firm's characteristics, contract variables and market characteristics. The regression is robust to heteroskedasticity. We winsorize the variables at 1%. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	Spread2
<i>Hard variables</i>	
D&B	-0.123** [0.031]
LEVERAGE	-0.103** [0.038]
EXP	-0.013 [0.253]
FIRM DEFAULT	-0.047 [0.815]
JUDGMENTS	0.444 [0.209]
BANKRUPTCY	-0.063 [0.875]
D&B * SIZE	0.050 [0.462]
<i>Other Relationship variables</i>	
PRIORRL	-0.201 [0.311]
LGPOLICIES	-0.921** [0.010]
PREVLOAN	0.009 [0.979]
PDTQ	0.193 [0.594]
PDTA1	0.449 [0.197]
PDTA2	0.035 [0.922]
PDTA3	0.038 [0.893]
<i>Discretion variables</i>	
CAPT1	5.426*** [0.000]
CAPT2	0.312 [0.662]
NOBANK	0.319 [0.310]
CHANGEBK	-0.568 [0.329]
SIZE	0.005 [0.959]
OWNER AGE	1.024 [0.124]
FEMALE	-0.043 [0.854]
WHITE	0.276* [0.057]

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BLACK	-0.182
	[0.766]
ASIAN	-0.109
	[0.803]
HISP	1.083***
	[0.003]
SUBS	0.217
	[0.382]
CORP	-0.031
	[0.899]
BHC	-0.114
	[0.589]
DISTANCE	-0.000
	[0.748]
<hr/> <i>Loan characteristics</i> <hr/>	
MATURITY	0.004
	[0.328]
AMOUNT	-0.288***
	[0.001]
CREDIT LINE	-1.059*
	[0.055]
LEASING CAPITAL	0.707
	[0.503]
MVE LOAN	-0.900
	[0.186]
RATIONING	0.025
	[0.856]
GARANTY	0.353**
	[0.030]
COST	0.136
	[0.180]
INDEX1	-0.435
	[0.236]
INDEX2	0.153
	[0.764]
<hr/> <i>Market characteristics</i> <hr/>	
DEFAULT PREM.	-0.284
	[0.173]
TERM PREM.	-0.194
	[0.695]
URBAN	1.875***
	[0.004]
<hr/>	
Industry dummies	Yes
Year dummy	Yes
Area dummies	Yes
<hr/>	
Constant	-0.714
	[0.808]
<hr/>	
Observations	676
R ²	0.299
Adjusted R ²	0.226
<hr/>	

Table A5

Determinants of relationship lending in SSBF 2003, Equation 4 (winsorized at 1%)

These regressions show the impact of the concentration on relationship lending. In an ordinary least squares regression (column 1), the dependent variable is the square of the residuals. The probit differences among columns (2), (3) and (4) come from the threshold chosen to define our Soft dummy. The three thresholds equal to 1σ , 1.1σ and 1.2σ , respectively. We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	(1)	(2)	(3)	(4)
	SOFT1 ε^2	SOFT2 1σ	SOFT3 1.1σ	SOFT4 1.2σ
<i>Market characteristics</i>				
HHI1	-0.792** [0.012]	-0.312 [0.444]	-1.104*** [0.000]	-1.013*** [0.000]
HHI2	0.191 [0.629]	0.233 [0.201]	0.171 [0.357]	0.153 [0.424]
<i>Bank-firm relation</i>				
PERSONAL	0.029 [0.943]	0.023 [0.912]	-0.009 [0.966]	-0.067 [0.762]
DREL	0.169 [0.649]	0.517* [0.052]	0.207 [0.437]	0.255 [0.350]
Constant	1.247*** [0.000]	-1.108*** [0.000]	-1.090*** [0.000]	-1.152*** [0.000]
R ²	0.006			
Adjusted R ²	0.000			
Pseudo R ²		0.025	0.023	0.021
Observations	676	676	676	676

Table A6

Determinants of relationship lending in SSBF 2003, Equation 5 (winsorized at 1%)

These regressions show the impact of the concentration on relationship lending. In an ordinary least squares regression (column 1), the dependent variable is the square of the residuals. The probit differences among columns (2), (3) and (4) come from the threshold chosen to define our Soft dummy. The three thresholds equal to 1σ , 1.1σ and 1.2σ , respectively. We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	(1)	(2)	(3)	(4)
	SOFT1	SOFT2	SOFT3	SOFT4
	ε^2	1σ	1.1σ	1.2σ
<i>Market characteristics</i>				
HHI	1.692 [0.182]	0.431 [0.700]	2.504*** [0.002]	2.304*** [0.006]
HHI ²	-0.300 [0.357]	-0.040 [0.870]	-0.467** [0.013]	-0.430** [0.026]
<i>Bank-firm relation</i>				
PERSONAL	0.029 [0.943]	0.023 [0.912]	-0.009 [0.966]	-0.067 [0.762]
DREL	0.169 [0.649]	0.517* [0.052]	0.207 [0.437]	0.255 [0.350]
Constant	-0.936 [0.416]	-1.812 [0.141]	-4.231*** [0.000]	-4.039*** [0.000]
R ²	0.006			
Adjusted R ²	0.000			
Pseudo R ²		0.025	0.023	0.021
Observations	676	676	676	676

Table A7

Determinants of spread in SSBF 2003-1998, Equation 2 (winsorized at 1%)

This regression shows the impact of the rating on the spread of the last approved credit. Our dependent variable is SPREAD2, which is the spread minus the mean spread of the zone of competitiveness. We also add control variables for the firm's characteristics, contract variables and market characteristics. The regression is robust to heteroskedasticity. We winsorize the variables at 1%. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	Spread2
<i>Hard variables</i>	
D&B	-0.070 [0.289]
LEVERAGE	-0.012 [0.871]
EXP	-0.004 [0.725]
FIRM DEFAULT	-0.060 [0.801]
JUDGMENTS	-0.499 [0.277]
BANKRUPTCY	0.151 [0.668]
D&B * SIZE	0.000 [0.998]
<i>Reason variables</i>	
PRIORRL	-0.127 [0.461]
LGPOLICIES	-0.747* [0.059]
PREVLOAN	-0.119 [0.675]
PDTQ	0.396 [0.441]
PDTA1	0.298 [0.464]
PDTA2	0.004 [0.992]
PDTA3	0.014 [0.964]
<i>Discretion variables</i>	
CAPT1	4.531*** [0.000]
CAPT2	1.410** [0.039]
NOBANK	0.356 [0.315]
CHANGEBK	-0.172 [0.790]
SIZE	0.050 [0.590]
OWNER AGE	0.158 [0.825]
FEMALE	0.178 [0.473]
WHITE	0.236 [0.269]

Chapter 1: Impact of banking competition of the use of soft information

BLACK	-0.908
	[0.143]
ASIAN	0.586
	[0.197]
HISP	0.968**
	[0.024]
SUBS	-0.030
	[0.898]
CORP	-0.284
	[0.241]
DISTANCE	0.001
	[0.217]
<i>Loan characteristics</i>	
MATURITY	-0.001
	[0.863]
AMOUNT	-0.241***
	[0.007]
CREDIT LINE	0.441
	[0.135]
LEASING CAPITAL	2.158**
	[0.014]
MVE LOAN	0.819*
	[0.094]
RATIONING	0.083
	[0.712]
GARANTY	-0.105
	[0.545]
COST	0.187**
	[0.039]
INDEX1	-0.508
	[0.195]
INDEX2	-0.013
	[0.979]
<i>Market characteristics</i>	
DEFAULT PREM.	-0.198
	[0.260]
TERM PREM.	-0.378
	[0.441]
URBAN	0.311
	[0.491]
Industry dummies	Yes
Year dummy	Yes
Area dummies	Yes
Constant	0.084
	[0.979]
Observations	900
R ²	0.188
Adjusted R ²	0.126

Table A8

Determinants of relationship lending in SSBF 2003-1998, Equation 4 (winsorized at 1%)

These regressions show the impact of the concentration on relationship lending. In an ordinary least squares regression (column 1), the dependent variable is the square of the residuals. The probit differences among columns (2), (3) and (4) come from the threshold chosen to define our Soft dummy. The three thresholds equal to 1σ , 1.1σ and 1.2σ , respectively. We control for bank-firm relationship and firm characteristic variables. The regression is robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	(1)	(2)	(3)	(4)
	SOFT1 ε^2	SOFT2 1σ	SOFT3 1.1σ	SOFT4 1.2σ
<i>Market characteristics</i>				
HHI1	-1.357*** [0.001]	-0.938** [0.013]	-0.884** [0.029]	-0.860** [0.049]
HHI2	0.878* [0.098]	0.314** [0.034]	0.245 [0.113]	0.251 [0.115]
<i>Bank-firm relation</i>				
PERSONAL	-0.226 [0.664]	-0.127 [0.397]	-0.072 [0.647]	-0.025 [0.879]
DREL	2.460** [0.015]	0.662*** [0.000]	0.522*** [0.006]	0.477** [0.015]
Constant	1.763*** [0.000]	-0.942*** [0.000]	-1.061*** [0.000]	-1.159*** [0.000]
R ²	0.040			
Adjusted R ²	0.036			
Pseudo R ²		0.062	0.042	0.038
Observations	900	900	900	900

Table A9

Determinants of relationship lending in SSBF 2003-1998, Equation 5 (winsorized at 1%)

These regressions show the impact of the concentration on relationship lending. In an ordinary least squares regression (column 1), the dependent variable is the square of the residuals. The probit differences among columns (2), (3) and (4) come from the threshold chosen to define our Soft dummy. The three thresholds equal to 1σ , 1.1σ and 1.2σ , respectively. We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	(1)	(2)	(3)	(4)
	SOFT1 ε^2	SOFT2 1σ	SOFT3 1.1σ	SOFT4 1.2σ
<i>Market characteristics</i>				
HHI	2.076 [0.201]	1.874* [0.065]	1.843* [0.090]	1.774 [0.128]
HHI ²	-0.240 [0.567]	-0.312 [0.151]	-0.320 [0.167]	-0.304 [0.218]
<i>Bank-firm relation</i>				
PERSONAL	-0.226 [0.664]	-0.127 [0.397]	-0.072 [0.647]	-0.025 [0.879]
DREL	2.460** [0.015]	0.662*** [0.000]	0.522*** [0.006]	0.477** [0.015]
Constant	-1.431 [0.308]	-3.442*** [0.003]	-3.468*** [0.005]	-3.489*** [0.008]
R ²	0.040			
Adjusted R ²	0.036			
Pseudo R ²		0.062	0.042	0.038
Observations	900	900	900	900

Table A10

Determinants of relationship lending in SSBF 2003-1998, Equation 4 (winsorized at 1%)

These regressions show the impact of the concentration on relationship lending. In an ordinary least squares regression (column 1), the dependent variable is the square of the residuals. The probit differences among columns (2), (3) and (4) come from the threshold chosen to define our Soft dummy. The three thresholds equal to 1σ , 1.1σ and 1.2σ , respectively. We control for bank-firm relationship and firm characteristic variables. The regression is robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	(1)	(2)	(3)	(4)
	SOFT1 ε^2	SOFT2 1σ	SOFT3 1.1σ	SOFT4 1.2σ
<i>Market characteristics</i>				
HHI1	-0.656 [0.265]	-0.080 [0.883]	-0.082 [0.891]	0.002 [0.997]
HHI1 * Y2003	-1.543*** [0.000]	-1.685*** [0.000]	-1.548*** [0.000]	-1.878*** [0.000]
HHI2	2.446** [0.010]	0.723*** [0.000]	0.495** [0.015]	0.492** [0.020]
HHI2 * Y2003	-0.064 [0.900]	0.011 [0.948]	0.064 [0.724]	0.077 [0.679]
<i>Bank-firm relation</i>				
PERSONAL	0.231 [0.687]	0.017 [0.916]	0.020 [0.906]	0.067 [0.701]
DREL	2.197** [0.029]	0.611*** [0.002]	0.491** [0.013]	0.450** [0.028]
Constant	1.527*** [0.000]	-1.019*** [0.000]	-1.111*** [0.000]	-1.210*** [0.000]
Year dummy	Yes	Yes	Yes	Yes
R ²	0.061			
Adjusted R ²	0.055			
Pseudo R ²		0.093	0.056	0.052
Observations	900	900	900	900

Table A11

Determinants of relationship lending in SSBF 2003-1998, Equation 5 (winsorized at 1%)

These regressions show the impact of the concentration on relationship lending. In an ordinary least squares regression (column 1), the dependent variable is the square of the residuals. The probit differences among columns (2), (3) and (4) come from the threshold chosen to define our Soft dummy. The three thresholds equal to 1σ , 1.1σ and 1.2σ , respectively. We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroskedasticity. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ (in brackets).

Dependent variable	(1)	(2)	(3)	(4)
	SOFT1 ε^2	SOFT2 1σ	SOFT3 1.1σ	SOFT4 1.2σ
<i>Market characteristics</i>				
HHI	5.095 [0.270]	0.569 [0.709]	0.895 [0.588]	0.993 [0.545]
HHI * Y2003	1.576 [0.213]	3.568*** [0.000]	3.139*** [0.001]	3.777*** [0.000]
HHI ²	-0.882 [0.458]	-0.040 [0.904]	-0.149 [0.674]	-0.184 [0.603]
HHI ² * Y2003	-0.214 [0.517]	-0.682*** [0.002]	-0.585*** [0.007]	-0.702*** [0.003]
<i>Bank-firm relation</i>				
PERSONAL	0.580 [0.325]	0.095 [0.576]	0.093 [0.597]	0.157 [0.401]
DREL	1.854** [0.048]	0.538*** [0.005]	0.415** [0.033]	0.356* [0.075]
Constant	-3.415 [0.342]	-1.653 [0.324]	-1.961 [0.283]	-2.045 [0.259]
Year dummy	Yes	Yes	Yes	Yes
R ²	0.079			
Adjusted R ²	0.071			
Pseudo R ²		0.104	0.068	0.071
Observations	900	900	900	900

Chapter 2:
Borrowing Challenges for Minorities:
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Can relationship-lending technology be used to overcome discrimination, as the Allport's (1954) contact hypothesis suggests? Or should minorities stay away from the bank? Using a sample of SMEs from the Survey of Small Business Finances 2003, this article shows that though relationship-lending technology generally reduces the spread and probability of the need to provide collateral for a loan, use of such technology actually leads to *greater* discrimination against minorities. Asians are the most negatively affected by this effect, followed by Afro-Americans and Hispanics. However, this effect occurs only when the length of the relationship is short; it tends to disappear when relationships are longer. With regard to the area in which a firm is located, there is less discrimination in areas with high minority population rates than in areas with low minority population rates. These results are robust with regard to the self-selection problem.

Chapter 2: Borrowing Challenges for Minorities: How Lending Technologies Affect
Discrimination in the SME Credit Market

1 Introduction

The issue of discrimination has been analyzed in many fields. In finance, several studies explore discrimination in consumer credit markets (e.g., Duca and Rosenthal, 1993; Berkovec *et al.*, 1994; Bertrand *et al.*, 2005), but only a few examine the issue in the credit markets of small and medium-sized enterprises (SMEs). The studies show that discrimination based on race and gender exists in the SME credit market (Cavalluzzo and Cavalluzzo, 1998; Blanchflower *et al.*, 2003; Bellucci *et al.*, 2010) and that it is driven by lenders' stereotypes rather than by the demand side (Blanchard *et al.*, 2008).

The problem of discrimination begins with the credit application. Cavalluzzo *et al.* (1999), in the 1998 National Survey of Small Business Finances (NSSBF), showed that Hispanics and women have a higher probability of deciding not to apply for credit, even if they need it, because they think their applications will be denied. Chakravarty and Xiang (2013) confirm the finding with regard to women, thus leading to the development of the theory of discouraged borrowers. Micozzi and Lucarelli (2016) point out that, for women, this problem stems more from sex-based stereotypes than from firm performance. Even when they decide to apply for credit, minorities and women have a higher probability than others of having their credit denied.²¹

Table 1 summarizes various prior results on this subject. (All the cited studies are based on a U.S. survey of SMEs conducted by the Survey of Small Business Finances (SSBF), with the exception of Bellucci *et al.* (2010), who studied Italian SMEs.)

²¹ Credit denied corresponds to a total rationing and does not take into account partial rationing.

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Table 1

Literature on the impact of being a minority on the probability of being denied

	Female	Afro-American	Hispanic	Asian	Native/Islander
Cavalluzzo and Cavalluzzo (1998)	^{-b}	+	+	∅	∅
Cavalluzzo <i>et al.</i> (1999)	^{+a} / ^{-b}	+	∅	+	∅
Blanchflower <i>et al.</i> (2003)	+	+	+/∅	+	+
Blanchard <i>et al.</i> (2008)		+	+	+	∅
Bellucci <i>et al.</i> (2010)	+				
Asiedu <i>et al.</i> (2012)	∅	+	+	+/-	+/-
Aristei and Gallo (2016)	+				

+ Significant result that the probability of being denied increases

- Significant result that the probability of being denied decreases

∅ No significant result

^a Coefficient significant in high concentrated area

^b Coefficient significant in low concentrated area

Results consistently show that Afro-Americans, Asians, Natives, and Hispanics have a higher probability of having their credit denied. Only one study shows a result that changes over time: Blanchflower *et al.* (2003) find that Hispanics were discriminated against in 1993 but not in 1998, possibly because of stronger regulation. Asiedu *et al.* (2012) find that Asians, Natives, and Hawaiians are more restricted in obtaining new credit but have a higher probability of having their old credit renewed; discrimination may be a factor when a bank officer is facing a new client but not when a client is already known. Women are more credit-restrained than men, not only in the United States but also in European countries (Aristei and Gallo, 2016). However, Cavalluzzo *et al.* (1999) point out that this finding depends on the degree of banking concentration: In low-concentration areas, women have an advantage (the coefficient is negative), but in high-concentration areas, they are at a disadvantage (the coefficient is positive) and have a higher probability of being denied. Becker (1971) proposes an explanation for the impact of concentration on discrimination. That is, discriminators increase their transaction costs when they face the minorities they discriminate against, with the aim of either not concluding contracts with the minorities—because of their high costs—or of making the minorities pay a higher price. Under these conditions, competition should lead to a decrease in

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discrimination because discriminating firms pay higher costs; they are eliminated from the market by non-discriminating firms that have lower costs.

With regard to loan rates, findings related to the impact of female ownership differ. On the one hand, Cavalluzzo and Cavalluzzo (1998) show that female owners pay a lower rate than male owners; this result is supported by Blanchard *et al.* (2008) and Asiedu *et al.* (2012) but only for credit in 1998. On the other hand, Coleman (2000) finds that female owners obtain loans at higher rates of interest than male owners. Cavalluzzo *et al.* (1999) and Alesina *et al.* (2013) explain this difference by including an interaction term between a market concentration indicator and the female-ownership dummy; they find that in low-concentration areas, women pay higher interest rates than men, but the rate decreases as concentration increases. This finding contradicts Becker's (1971) prediction that interest rates increase along with level of concentration. Cavalluzzo *et al.* (1999) explain these unexpected results by suggesting there is a difference based on credit type (e.g., line of credit, leasing) that studies do not properly control for. They show that when only lines of credit are examined, there is no difference in interest rates charged to minorities according to their demographic areas. These findings also explain the absence of results for Blanchflower *et al.* (2003) and Bellucci *et al.* (2010).

With regard to minorities, research results are consistent: They are charged higher interest rates than Whites. Cavalluzzo and Cavalluzzo (1998) show that Hispanics and Asians are charged the highest rates in concentrated areas. Asiedu *et al.* (2012) confirm this finding with regard to Hispanics; they find a rate about two points higher. However, Blanchard *et al.* (2008) find that Afro-Americans and Hispanics are discriminated against only when they borrow from finance companies and businesses, that is, companies that have a primary activity other than lending, a finding that can be explained by the lack of control that federal regulatory authorities exert over these types of companies. Cavalluzzo *et al.* (1999) find that Afro-Americans benefit from positive discrimination in concentrated areas (approximately ten points percentage lower), but for women, these findings disappear when they focus on lines of credit.

Bellucci *et al.* (2010) investigate gender discrimination with regard to collateral and overdraw.²² When female owners do not pay more than men, they have a higher probability (about 5.2%)

²² Overdraw is a dichotomous variable that takes the value of 1 if the borrower uses more than the amount granted on the credit line by the bank and 0 otherwise. In Italy, firms can draw more credit than the amount actually granted by the bank, but they must pay extra fees or a higher rate in return (Bellucci *et al.*, 2010).

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of providing collateral. Women overdraw 4% more frequently than men and so are more credit-limited. The authors also examine the impact of relationship length on credit conditions for women. They show there is no impact of relationship length for women on spread, collateral, or overdraw, even though relationship length usually decreases the interest rate, probability of providing collateral, and overdraw.

Given these assessments, we ask, How can minorities overcome discrimination? A potential answer comes from psychology, based on the “contact hypothesis” developed by Allport (1954). This hypothesis states that intergroup contacts—that is, contacts between two groups who belong to different ethnic backgrounds—can lead to increased knowledge of the other group and thereby reduce intergroup prejudice, but only if several conditions are met. When they are not met, the discrimination problem becomes worse. We find several empirical examples of this theory in psychology, criminology, and sociology.²³ To transfer this hypothesis to finance, we must identify the banking equivalent to Allport’s (1954) notion of contact. We propose that this equivalent is the use of relationship lending technology (LT) in firm–bank dealings. Berger and Udell (2006) show that banks use two types of LTs in their relationships with firms:

- *Transaction-based lending technology (LT)*, which is primarily based on borrowers’ hard information.
- *Relationship-based lending technology (LT)*, which is primarily based on borrowers’ soft information.

Hard information is quantitative, such as financial statements; it needs only a few interactions and is easily transferable. Soft information is qualitative, such as CEO motivation, obtained via multiple personal interactions between the firm and the bank, and is difficult to transfer (Stein, 2002). This means that relationship LT is primarily based on multiple personal interactions—one of the key conditions of the contact hypothesis.

Moreover, there are many papers in finance about the impact of relationship lending on access to credit and credit conditions. All agree that credit availability is positively affected by relationships. Through time, banks accumulate qualitative information about the firms that allows them to reevaluate and possibly offer the firms credit. However, with regard to the

²³ For more detail, see the meta-analysis of Pettigrew and Tropp (2006).

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impact of relationship lending on credit conditions, the results are ambiguous, in terms of both spread and collateral.²⁴

There is ample theoretical and empirical evidence that relationship LT and belonging to a minority have an impact on the separate factors of credit availability, interest rates, and collateral, but only Bellucci *et al.* (2010) examine the interaction between these factors. Even then, they limit their investigation to the interaction term between the dummy, female, and the length of relationship. Nevertheless, length of relationship is a poor proxy for relationship LT; even when a long relationship length favors the development of relationship LT, we find transactional LT. The main contribution of this paper is to measure, more accurately, the interaction between minorities and the LT developed between firms and banks, and then to determine how it affects discrimination in the credit market.

Allport's contact hypothesis proposes that contacts increase the knowledge between two groups and reduce discrimination. Therefore, we could infer that the use of relationship LT, which multiplies the contacts between minorities and loan officers, decreases discrimination, and results in credit conditions for the minorities populations who use it that are the same or better than credit conditions for others.

However, we could also argue that such contact *exacerbates* the discriminatory tendencies of loan officers, by circumventing traditional practices. To use relationship LT, banks must delegate some of their decision power to loan officers, allowing them to use that power to discriminate. But in cases of transactional LT, credit decisions are made by someone other than loan officers. Information about the characteristics and qualities of firms and their owners are transmitted through a series of meetings, but information about race is not transmitted, because it is forbidden to register any potentially discriminatory information. In this way, transactional LT helps protect minorities from discrimination.

This reasoning leads to contrasting hypotheses:

H1: Relationship lending technology permits minorities to overcome discrimination.

H1': Transactional lending technology permits minorities to overcome discrimination.

²⁴ See Degryse *et al.* (2009) for a complete literature review of the impact of relationship lending on credit conditions and Cenni *et al.* (2015) for a literature review of the impact of relationship lending on rationing.

We organize this paper as follows: Section 2 describes our database, the model, and the variables used. Section 3 presents the results of our study and Section 4 concludes.

2 Data and methodology

2.1 Database

In this study, we use the 2003 Survey of Small Business Finances (SSBF), conducted by the Board of Governors of the Federal Reserve System. This database contains information on 4,240 SMEs.²⁵ It includes details of balance sheets and income statements (e.g., liabilities, assets, income) and firms' and owners' characteristics and relationships with financial service suppliers, for a broad set of products and services (Mach and Wolken, 2006). This database is used frequently for research on relationship banking (e.g., Berger and Black, 2011; Berger and Udell, 1995; Petersen and Rajan, 1994) and discrimination (Cavalluzzo and Cavalluzzo., 1998; Cavalluzzo *et al.*, 1999; Blanchard *et al.*, 2008).

Our sample is composed of all firms that had credit granted during 2002–2004. Our focus on these three years permits us to use all available information about credit needed, asked for, or obtained. In a series of exclusions, we retain only firms that are non-FIRE (financial, insurance, or real estate) because of their specificities (79 observations removed), obtained credit from commercial banks or assimilated (196 observations removed), and only observations with complete sets of information (704 observations removed). Finally, to avoid interpretation problems and because they represent only 6 observations, we exclude firms that indicated they had sometimes obtained credit during the last three years and sometimes had not. Our final sample is composed of 775 observations for the period 2002–2004.

2.2 Empirical methodology

2.2.1 Credit condition equation

The aim of this step is to determine the impact of the lending technology used by minorities on credit conditions. The baseline equation for testing our hypotheses is:

$$Y_i = \alpha + \beta * LT_i + \gamma * Minorities_i + \delta * (LT_i * Minorities_i) + \theta * Control_i + \varepsilon_i \quad (1)$$

²⁵ An SME is defined as a firm with fewer than 500 full-time-equivalent employees

where:

- Y_i is a credit condition variable,
- LT_i is the lending technology indicator,
- $Minorities_i$ is a vector composed of gender and ethnic variables,
- $LT_i * Minorities_i$ is a vector composed of an interaction term between our lending technology indicator and each minority indicator,
- $Control$ is a vector of control variables.

2.2.2 Self-selection bias

There is a potential self-selection problem in our sample, because it is composed only of firms that obtain credit. To correct the problem, we use Heckman's (1979) methodology to estimate the probability that a firm obtains credit, then calculate the inverse Mills ratio (also known as Heckman lambda) as a selection factor. We include this factor in all equations that need correction—in our case, credit condition, Equation (1).

However, Cavalluzzo *et al.* (1999) and Cole and Sokolyk (2015) show that the self-selection problem persists when we estimate the probability that a firm obtains credit; we must correct it by taking into account the probability of asking for credit, which must itself be corrected by taking into account the probability of needing credit (see Figure 1).

To avoid the self-selection problem in our analysis, we use Cole and Sokolyk's (2015) methodology. We first construct three indicator variables in our sample:

- NEED is equal to 1 if the firm declares that it applied for a loan at least once during the last three years or if it did not apply because of the assumption that the application would be turned down even though it needed credit.
- APPLY is equal to 1 if the firm declares that it applied for a loan at least once during the last three years.
- OBTAIN is equal to 1 if the firm obtained a loan during the last three years.

Next, we regress our NEED indicator on a set of independent variables (composed of firm, owner, market characteristics, and some macroeconomic variables, as in Cavalluzzo *et al.*,

1999) and calculate the inverse Mills ratio²⁶. We include this ratio in the estimation of our second regression (in which the dependent variable is APPLY). We reproduce this method for APPLY and OBTAIN, and finally finish by calculating the inverse Mills ratio λ_3 that we use in all regressions related to credit conditions, to correct the potential self-selection problem.

2.3 Variables

2.3.1 Credit condition variables

The aim of this step is to analyze the role of gender, minorities, and relationship LT on credit conditions, especially on premium rate (with and without fees), collateral, and credit availability, which are the four dependent variables in Equation (1).

The first credit condition variable is the loan premium rate of the most recent loan (LPR). We reconstruct our variable according to Berger and Udell (1995) and Brick and Palia (2007), subtracting the prime rate at the time of loan application from the interest rate. We use this variable as a proxy of the spread of the loan. The average loan premium rate is about 1.463%. Table A2 provides a means-comparison test between Male and Female and between Whites and Minorities. With regard to LPR, we can see that Females pay a higher rate than Males (1.904% and 1.373% respectively), and Whites pay a lower rate than Minorities (1.497% and 2.402%, respectively). When we split our Minority indicator into three categories (Afro-American, Hispanic, and Asian), we note that Hispanics pay a significantly higher rate (3.030%).

To deal with the potential endogeneity problem between the loan premium rate and the fees of the loan, we reconstruct a new variable, loan premium rate with fees (LPRF), which is the sum of the loan premium rate and the ratio of total fees collected by the lending institution to the amount granted, divided by the maturity of the loan in months (Brick and Palia, 2007). Overall, the LPRF is about 1.471; Females pay a higher rate than Males and Minorities pay a higher rate than Whites.

Our second credit condition variable is collateral, which is a dummy equal to 1 if collateral is required for the credit. In our sample, collateral is required in 61% of the loans and the opposite

²⁶ The Mills ratio is calculated as follows: $\lambda(\cdot) = \frac{\phi(\cdot)}{\Phi(\cdot)}$, where $\phi(\cdot)$ is the standard normal density function and $\Phi(\cdot)$ is the standard normal cumulative distribution function of the linear prediction of our dependent variable.

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of LPR and LPRF applies, in that collateral requirements for Females, Afro-Americans, and Hispanics are less than for Males or Whites. We are aware that COLLATERAL is a dummy variable; however, as Norton *et al.* (2004) explain, we cannot interpret the effect of an interaction term directly in a non-linear regression. Because the interaction term in our model is central to our research, we ran probability linear regressions, rather than Probit or Logit forms, to avoid interpretation problems.

The last dependent variable is credit availability. This variable is equal to the amount applied, divided by the amount granted; the higher the ratio, the higher the availability for the firm. On average, all firms obtain roughly the requested amount (98%), and there is no significant difference between Males and Females; however, Minorities are more credit restrained overall than Whites.

2.3.2 Minority indicators

We split our Minorities vector into two sets of variables: gender and ethnic minorities. For gender, we construct a dummy variable, Female, that is equal to 1 when the manager of the firm is a woman. In our sample, women manage 17% of firms. Alesina *et al.* (2013) and Bellucci *et al.* (2010) cite female firm ownership rates of 18% and 23%, respectively, but their figures do not refer to female *management* of firms.

With regard to ethnic minorities, we use all minority indicators available in the data set, with the exception of Natives and Hawaiians. Because these minorities represent only 0.4% of our sample and are protected by specific laws, we do not take them into account. To examine the overall effect of being a minority, we construct an overall indicator, MINORITY, which equals 1 when the manager belongs to a minority (Afro-American, Hispanic, or Asian). Next, we split this indicator into three to determine whether there is overall discrimination, or whether it is directed only at specific minorities:

- AFAM equals 1 if the manager is Afro-American. In our sample only 1% of firms are managed by Afro-Americans.
- HISP equals 1 if the manager is Hispanic (1.8% of our sample).
- ASIAN equals 1 if the manager is Asian (2.8% of our sample).

2.3.3 Relationship lending technology indicator

We use a lending technology indicator built by Berger and Black (2011). We choose this measure because it takes into account both sides of lending technology: the information emitted by the firm and the information managed by the bank. As noted previously, these authors identify both hard information technology, or transactional LT, which is based on fixed-asset lending technology and some characteristics of the firm or the bank, and soft information technology, that is, relationship LT (see Appendix 1).

We reproduce this method to build our own lending technology indicator, RL, which is a dummy equal to 1 if the firm and the bank use relationship LT. Berger and Black (2011) take bank size into account in their construction, but this information is not available in SSBF 2003. We replace this information with bank affiliation with a holding company, which is a proxy for bank size (Breit and Arano, 2008).

In our sample, 6.8% of the lending technologies are relationship LT. Only 10.7% of White managers use soft lending technology, but 37.5% of Afro-American managers and 22.7% of Asian managers use soft lending technology.

2.3.4 Control variables used in our credit condition equation

To minimize the potential risk of omitted variables, we control for a large set of variables from six categories: characteristics of the loan, characteristics of the firm, characteristics of the owner/manager, characteristics of the bank, and market macroeconomic variables (see Table A1 for a complete description of the data set).

The first set of variables presents loan characteristics with its amount (AMOUNT), its maturity (MATURITY), credit type (CREDIT LINE, LEASING CAPITAL, or MVE LOAN), and rate type, fixed or variable (FIXED). According to the dependent variable analyzed, we also control for LPRF, COLLATERAL, AVAILABILITY, and COST, which represents the extra cost paid for the credit (used only in the equation in which the dependent variable is LPR). Brick and Palia (2007) show there is a problem of endogeneity between the spread and the collateral. However, in our case, this potential endogeneity does not matter as long as we do not try to interpret the coefficient of our endogenous variable. Lechner (2008) explains that if the conditional independent assumption holds—that is, there is no endogeneity between the control variables and the minority and relationship indicators—we can interpret those indicators.

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The second set of control variables is composed of firm characteristics. We split this set into two parts. The first is credit history, composed of JUDGMENT and DEFAULT FIRM, which measure, respectively, previous judgments against the firm and whether the firm has declared default during the last three years (which should negatively impact the credit conditions). Next, we control for size of firm (SIZE) and firm age (AGE) as proxies of the bargaining power of the firm's leverage (LEVERAGE) as a measure of creditworthiness (D'Auria *et al.*, 1999), ROA as a measure of profitability of the firm, and rating of the firm (D&B). In SSBF 2003, the rating is by Dun & Bradstreet; it is divided into six categories that range from 1 (riskiest) to 6 (least risky). The better the firm (more profitable, higher rating), the better the credit conditions. We also add industry dummies, to control for any sector impact, and legal-form dummies (S-Corporation and C-Corporation) because they can explain a difference in opacity of firm evaluation by the bank.

We control for owner or manager characteristics, because in some cases, banks use such information to complement information about firm characteristics (Berger *et al.*; 2011). We add BANKRUPTCY, an indicator variable that equals 1 if the main owner declared bankruptcy within the past 3 years, and EXP, the weighted average experience of all owners, as proxies. Moreover, we control for the owner net wealth (WEALTH).

To control for the role of the bank during the credit negotiation, we add the only bank variable available: BHC, which is a dummy equal to 1 if the bank is affiliated to a bank holding company.

We include DEFAULT PREMIUM and TERM PREMIUM as measures of the market characteristics (Brick and Palia; 2007). We also control for banking competition (because it could affect credit conditions and the use of soft information) through three proxies: HHI, the banking market concentration in the zone where the firm is located (Petersen and Rajan, 1995; Boot and Thakor, 2000); URBAN, a dummy equal to 1 if the firm is located in an urban region; and the bank-firm distance (DISTANCE) (Degryse and Ongena, 2007).

Finally, we add macroeconomic variables. Bostic and Lampani (1999) prove that local geographic characteristics are correlated with ethnicity and credit conditions and that omitting these variables could bias the estimation. They show that these variables can act in two ways. First, discrimination is greater in areas in which the concentration of minorities is greater. Second, economic variables, which are correlated with minorities, can also explain credit

conditions. For example, the local economy is a determinant of the survival of SMEs and can explain the choice of the bank to lend (or not lend) and at what price.

We complete the SSBF 2003 data set with data from the Bureau of Labor Statistics. Our key variable for merging both data sets is the census²⁷ that corresponds to the location of the firm. We add economic variables—unemployment rate, poverty rate, average personal income, characteristics of local minorities, ethnic population rate (on regression about ethnic impact), and female population rate (on regression about female impact).

3 Results

3.1 *Who needs credit, who asks for it, and who obtains it?*

The results (see Table A3 in annex) reveal that all minorities have the same probability of needing credit. The behavior of the manager, with regard to the need for credit, does not depend on race or gender. We also observe that the Hispanic and Asian coefficients are negative and significant. These groups are less likely to ask for credit than other groups even though they have the same credit needs as others. These results support the finding of Cavalluzzo *et al.* (1999) that minorities prefer not to ask, because they think that they will be denied.

However, if they do ask, Afro-Americans present negative, highly significant coefficients, which means they have a lower probability of obtaining credit than others. Again, these results confirm the finding of Cavalluzzo *et al.* (1999) that discrimination exists in credit decisions. These results also support the existence of a potential self-selection bias.

3.2 *Discrimination, relationship lending technology, and credit conditions*

Tables A4 display our results concerning the impact of minorities and relationship LT on credits conditions. We run three different estimations: the first using MINORITY (Table A4-1), to determine the overall impact of a manager belonging to a minority, the second using each minority indicator (AFAM, ASIAN, and HISP, see Table A4-2) to determine whether there are differences across the minority, and the third using FEMALE (Table A4-3) to capture the impact of female owners.

²⁷ In the United States, there are nine census versions: East North Central, East South Central, Middle Atlantic, Mountain, New England, Pacific, South Atlantic, West North Central, and West South Central.

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Table A4-1 shows that overall, minorities who develop relationship LT with their banks pay a higher rate (approximately 4.5% more) than if they use transactional LT. However, this effect disappears when we take loan fees into account (columns 3 and 4); if the rate is initially higher, it is compensated for by lower fees. Minorities must also provide more collateral (columns 5 and 6) and are more credit-restrained (columns 7 and 8). However, minorities who use transactional LT are not discriminated against.

When we focus on each minority's impact of using relationship LT (Table A4-2) on the loan rate (columns 1 to 4), we note that minorities pay higher rates than Whites, whether or not we take extra fees into account in our dependent variable (LPR and LRPF). Only Hispanics are discriminated against on their loan premium rates without fees. This discrimination problem exists only when minorities use relationship LT. The coefficients for all minorities who use transactional LT (i.e., AFAM, HISP, and ASIAN) are either not significant or are positive and significant (Afro-Americans).

We see mixed results with regard to collateral (column 5 and 6). Hispanics and Asians must provide more collateral when they use relationship LT, but collateral requirements for Afro-Americans are less than those for Whites. Again, there is no discrimination problem when minorities use transactional LT.

With regard to credit availability (column 7 and 8), the only significant result pertains to Asians who use relationship LT; they are more credit-restrained than Whites or other minorities.

Although discrimination exists between Minorities and Whites, Table A4-3 shows that there is no discrimination between Males and Females.

These results reveal that ethnic minorities are clearly discriminated against when they use relationship LT but not when they use transactional LT, which confirms H1': The use of relationship lending, that is, contact between firm managers and loan officers, exacerbates the discrimination tendencies of loan officers.

3.3 Does discrimination evolve through the length of relationship?

Asiedu *et al.* (2012) point out that, though Asians and Natives/Hawaiians are more restricted in their new credit, this restriction disappears when their old credit is renewed. Allport (1954) shows that multiple contacts are needed to decrease the tendency to discriminate; therefore, such a decrease requires time. Even if contact helps decrease the tendency to discriminate, it

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takes time to compensate for initial rejections; over time, minorities who use relationship LT should see a greater improvement to their credit conditions than non-minorities. To test this hypothesis, we estimate the following equation on a sub-sample of 91 firms that use relationship LT:

$$Y_i = \alpha + \beta * Length + \gamma * Minorities_i + \delta * (Length * Minorities_i) + \theta * Control_i + \varepsilon_i \quad (2)$$

where:

- Y_i represents credit condition variables (LPR, LPRF, Collateral, Availability),
- $Length$ is the length of relationship between the firm and the bank at the time of credit,
- $Minorities$ is the Minority/Female indicator, and
- $Control$ is the set of control variables.²⁸

We are aware that relationship length can be directly linked to being a minority. A short relationship length may be the result of past discrimination, and our analysis acknowledges that a longer relationship may be the consequence of an applicant being lucky enough to find a loan officer who does not discriminate. To check this effect, we follow Cavalluzzo and Cavalluzzo (1998) and regress the length of the firm's longest relationship on the set of variables used in our credit condition analysis (see Table A5, minority-only results displayed). Our model explains more than 30% of the variation of the length of relationship; it shows that being a minority has no impact.

Table A6 displays our results for Equation (2). With regard to Minorities (columns 1 to 4), the results show discrimination: they pay higher rates (whether or not we take into account extra fees) and must provide more collateral, though they have the same credit availability as Whites. However, with regard to our interaction term, we find that as the length of relationship increases, the loan premium rate decreases and credit availability increases, but we do not find any significant results concerning the loan premium rate with fees or collateral. The inference is that over time, minorities overcome some, but not all, of their initial rejections.

²⁸ To avoid any problem of multicollinearity because of the small size of the sub-sample, we reduce our number of control variables by removing market characteristics and macroeconomic variables and using only the Minority indicator instead of each sub-indicator. Results stay the same when we include these variables.

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With regard to Females (columns 5 to 8), we do not find any statistical evidence that they have an advantage when the length of relationship increases.

Our results show that discrimination tends to evolve with the length of relationship. This evolution seems to be positive overall for minorities who use relationship LT, which supports the idea that over time, the transmission of soft information is increased and discrimination by loan officers is decreased.

3.4 Does discrimination evolve with minority population rate?

In this step, we test whether discrimination depends on the minority population rate in the census in which the firm is located. We suggest three possible explanations for the link between discrimination and minority population rate.

First, the higher the minority population rate in the census, the higher the probability of having a loan officer who also belongs to a minority; therefore, discrimination decreases.

Second, Becker (1971) maintains that high bank concentration leads to a decrease in discrimination (banks that discriminate are eliminated from the market because of higher transaction costs). The same argument is possible with the minority population rate. As the rate increases, banks have a higher probability of facing a minority and if they discriminate, their transaction costs increase, which increases their probability of being eliminated from the market by non-discriminating banks. Therefore, a higher minority population rate leads to less discrimination.

Third, the psychological theory of tolerance level proposes that the higher the minority population rate in an area, the higher the tolerance level of the population of the area, and the lower the level of discrimination.

All these theories suggest that discrimination decreases as the minority population rate increases. Accordingly, we construct two sub-samples. The first is composed of all firms in a census in which the minority population rate is below the mean minority population rate (we use population rate of ethnic minorities and population rate of women to analyze respectively ethnic impact and female impact) in our sample (29% for ethnic minorities and 50% for females). The second sample is composed of firms in a census in which the minority population rate is above the mean minority population rate. We estimate Equation (1) according to these sub-samples.

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Table A7-1 provides results of our model for minorities. We note that when the minority population rate in the area is low, Hispanics and Asians who use relationship LT are discriminated against (column 1), but when we take extra fees into account (column 2), discrimination against Hispanics seems to disappear. Only Afro-Americans who use transactional LT appear to have an advantage in this area, because their interest rates are lower, but when we take into account the extra fees, that advantage disappears. Hispanics who use relationship LT and Asians who use transactional LT must provide more collateral than others (column 3). Only Asians present significant results about the amount of credit they obtain; they obtain less credit when they use relationship LT, and more when they use transactional LT.

In areas in which the minority population rate is high, discrimination tends to decrease or even disappear. (We use a Chow test to compare the coefficient of each regression in low and high rate-of-minority areas;²⁹ see final columns of Table A7-1). There is less probability that Hispanics must provide more collateral. Afro-Americans who use transactional LT obtain lower interest rates, whether or not we take extra fees into account. Afro-Americans who use relationship LT are less credit-constrained.

Table A7-2 provides results about females. It shows that women who use relationship LT in a low-concentration area benefit from positive discrimination with regard loan rates (with and without fees). Except for this result, we do not find any evidence of discrimination against women. This positive discrimination disappears as the female population rate increases.

Our results show that the level of discrimination differs according to the percentage of minorities in the area where a firm is located, and that the higher the ethnic population rate in the area, the better the credit conditions. The only exception is women who use relationship LT; they seem to benefit when their percentage is low rather than when it is high.

4 Conclusion

This paper begins with three assessments. First, minorities, Afro-Americans, Asians, and Hispanics are discriminated against in the credit market, with regard to the spread they pay, the collateral they must provide, and credit available to them. Second, the type of lending

²⁹ The Chow test is a statistical and econometric test of whether the coefficients in two linear regressions on different data sets are equal. The null hypothesis H_0 is $b_1 = b_2$, where b_1 is the coefficient for the variable X in Equation (1) and b_2 is the coefficient for the variable X in Equation (2). The alternative hypothesis H_1 is $b_1 \neq b_2$.

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technology they use can affect the level of discrimination they experience; relationship lending technology can either decrease the level of discrimination—by increasing knowledge between the loan officer and the minority—or increase the level of discrimination, by exacerbating the discriminatory tendencies of the loan officer. Third, lending relationships with banks can have an impact on credit conditions. Based on these assessments, we ask whether minorities can use relationship LT or transactional LT to overcome their discrimination problems. By applying Black and Berger's (2011) measure of relationship lending technology to the SSBF 2003 survey, we show that when minorities use relationship LT, they experience greater discrimination. This level of discrimination is highest for Asians, followed by Afro-Americans and Hispanics. For women, there is no advantage or disadvantage for developing relationships with their banks. We also show that discrimination evolves positively for ethnic minorities, and negatively for women, who use relationship LT in terms of length of relationship and minority/female population rate in the area. These results suggest that increased knowledge between two groups decreases discrimination, but this increase of knowledge is possible only over time and when favored by the environment of the firm. Finally, we note that our results are robust with regard to potential self-selection problems; we use the methodology of Cole and Sokolyk (2015) and calculate the inverse of the Mills ratio to correct in each step of our analysis (who needs, who asks for, and who obtains credit).

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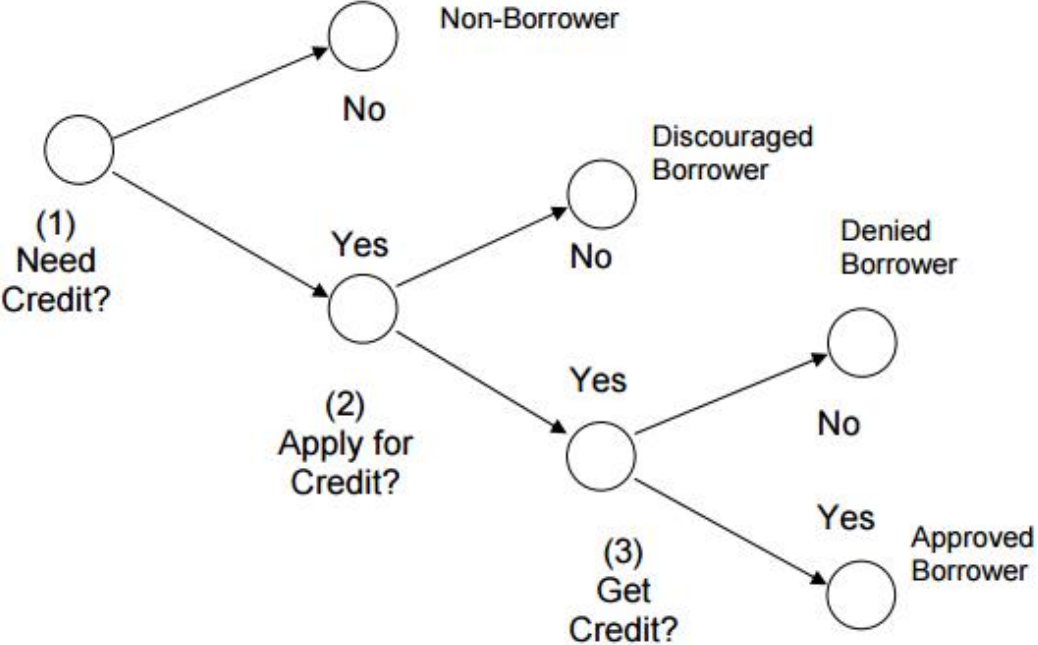
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Figure 1: Who needs, who applies for, and who gets credit?



Cole and Sokolyk (2015)

Appendix 1: Construction of Berger and Black's measure

In their paper, Berger and Black (2001) construct their indicator using the following method:

- First, they examine fixed-asset technology. They define fixed-asset technology as all technologies based on assets that are easily valued. In this category, they include leasing and all credit with commercial real estate, residential real estate, motor vehicles, equipment, or accounts receivable pledged as collateral.
- Next, they use firm and bank characteristics to construct two more cases of hard-information technology:
 - First, they assume that large firms (with total assets > \$1M) and with low leverage (leverage < 0.9) are evaluated based on hard information because their financial statement make them easily valued.
 - Second, they assume that when large banks (total assets > \$1B) evaluate small firms (total asset > \$1M), they primarily use hard information when credit is not important (amount < \$1K) and when firms/owners do not present any default or judgments. They explain that banks will not develop relationships (which are costly) when credit is not important and credit history of firms is good.
- Finally, they assume that all other credit is based on soft information.

Table A1

Descriptive statistics

The table shows the mean and standard deviation of each variable for a sample of loans in the 2003 SSBF.

Variable name	Description	Mean	Std. Dev.
<i>Dependent variables</i>			
RL	1 if the lending technology used by the bank is a relationship lending technology	0.117	0.322
FEMALE	1 if the manager is female, 0 otherwise	0.170	0.376
MINORITY	1 if the manager belongs to a minority, 0 otherwise	0.056	0.234
HISP	1 if the manager is Hispanic, 0 otherwise	0.018	0.133
AFAM	1 if the manager is Afro-American; 0 otherwise	0.010	0.101
ASIAN	1 if the manager is Asian, 0 otherwise	0.028	0.166
<i>Loan characteristics</i>			
LPR (Loan Premium Rate)	Interest Rate – Prime Rate	1.463	2.359
LPRF (LPR with Fees)	Interest Rate + Adjusted Fees (amortized over the life of the loan) – Prime Rate	1.471	2.316
COLLATERAL	1 if collateral was required	0.613	0.487
AVAILABILITY	Amount of credit granted/amount of credit applied for	0.980	0.099
FIXED	1 if the interest rate is fixed, 0 if it is variable	0.582	0.494
MATURITY	Maturity of the loan (months)	63.596	70.154
AMOUNT	Natural logarithm of the amount of the loan/credit granted/1000	4.865	1.827
COST	(Total amount of fees associated with the credit/Total amount of the credit granted) * 100	1.331	5.723
MVE LOAN	1 if the loan is a mortgage, vehicle, or equipment loan, 0 otherwise	0.566	0.496
CREDIT LINE	1 if the loan is a new line of credit or a line of credit renewal, 0 otherwise	0.306	0.461
LEASING CAPITAL	1 if the loan is a capital lease, 0 otherwise	0.019	0.138
<i>Firm characteristics</i>			
JUDGMENTS	1 if firm has been 60 or more days delinquent on business obligations within past 3 years	0.022	0.147
FIRM DEFAULT	1 if at least one judgment has been rendered against the firm within the past 3 years	0.195	0.396
D&B	Dun and Bradstreet Rank Credit Score - 1 most risky; 6 least risky	3.996	1.419
SIZE	Natural logarithm of total assets	13.295	2.239
ROA	Profit/Total assets	0.406	4.260
FIRM AGE	Logarithm of the age of firm in years	2.667	0.777
LEVERAGE	Log (Total debts/Total assets)	1.095	4.737
SUBS	1 if the firm is an S-Corporation	0.425	0.495
CORP	1 if the firm is a C-Corporation	0.299	0.458

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SIC1	1 if construction industry	0.119	0.324
SIC2	1 if manufacturing industry	0.166	0.373
SIC3	1 if wholesale industry	0.066	0.248
SIC4	1 if retail trade industry	0.174	0.380
SIC5	1 if services industry	0.341	0.474
<i>Owner characteristics</i>			
EXP	Weighted average experience of owners (year)	22.205	10.828
BANKRUPTCY	1 if the main owner has declared bankruptcy within the past 7 years	0.008	0.088
WEALTH	Total net wealth of the main owner	2.532	19.015
<i>Bank characteristic</i>			
BHC	1 if the bank is affiliated to a bank holding company	0.715	0.452
<i>Bank-firm relationship</i>			
LENGTH	Length of relationship with this bank at time of application (in months)	95.37	120.68
<i>Market characteristics</i>			
DISTANCE	Distance between firm and bank's main office (miles)	77.476	288.017
URBAN	1 if the firm is located in a rural county (opposition to MSA)	0.219	0.414
HHI	Banking market concentration 2003 - 100% bank deposits. Variable equal to 1 if $0 < \text{HHI} < 1000$; 2 if $1000 \leq \text{HHI} < 1800$ or 3 if $1800 \leq \text{HHI}$	2.431	0.606
DEFAULT PREM.	Market yield on U.S. Treasury securities of the closest term of the most recent loan minus the market yield on U.S. Treasury securities at 3-month constant Treasury	1.623	1.623
TERM PREM.	Moody's yield on BAA seasoned corporate bond minus the market yield on U.S. Treasury securities at 10-year constant maturity	2.447	2.447
<i>Macroeconomic variables</i>			
PERSONAL INCOME	Average personal income in the census where the firm is located	31615.430	2895.295
UNEMPLOYED	Unemployed rate in the census where the firm is located	5.942	0.658
POVERTY	Poverty rate in the census where the firm is located (in %)	12.38%	1.82%
FEMALE POP. RATE	Percentage of women in the census where the firm is located	50,72%	0,61%
ETHNIC POP.RATE	Percentage of ethnic minorities (Afro-American, Asian, Hispanic) in the census where the firm is located	0.291	0.073
<i>Year variables</i>			
YR_2002	1 if the loan was made in 2002, 0 otherwise	0.143	0.351
YR_2003	1 if the loan was made in 2003, 0 otherwise	0.315	0.465
Number of observations	775		

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Table A2

Univariate analysis

The table shows the mean for each variable of interest by gender and minorities. Asterisks correspond to the significance of a t-test of equality of the means (Women compared to Men, Minorities compared to Whites). * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$

Variables	Men	Women	White	Minority	AFAM	Hisp	Asian
LPR	1.373	1.904**	1.497	2.402***	1.510	3.039*	2.218
LPRF	1.372	1.955***	1.427	2.153**	1.546	2.024	2.286
COLLATERAL	0.629	0.530**	0.617	0.553	0.375*	0.428*	0.772
AVAILABILITY	0.978	0.983	0.981	0.944**	1.000	0.960	0.977
RL	0.120	0.106	0.107	0.276***	0.375**	0.214	0.227*

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Table A3

Results for need, ask, and obtain analysis

These regressions show the determinants of the need of credit (column 1), the credit ask (column 2) and the credit obtaining (column 3). All regressions are robust to heteroscedasticity. Asterisks denote p-values as * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$ (indicated in brackets).

Dependent variables	Need (1)	Ask (2)	Obtain (3)
<i>Owner characteristics</i>			
FEMALE	-0.036 [0.782]	0.136 [0.524]	0.045 [0.819]
HISP	0.059 [0.834]	-0.816** [0.030]	-0.399 [0.335]
AFAM	0.330 [0.321]	0.419 [0.384]	-1.643*** [0.000]
ASIAN	0.412 [0.106]	-1.026* [0.052]	-0.520 [0.183]
OWNER AGE	-0.448 [0.102]	0.856 [0.204]	0.447 [0.348]
OWNER EXPERIENCE			0.007 [0.516]
<i>Market characteristics</i>			
URBAN	-0.094 [0.459]	-0.084 [0.731]	0.234 [0.283]
HHI	0.118 [0.157]	-0.195 [0.332]	-0.174 [0.212]
<i>Firm characteristics</i>			
LIQUIDITY	-0.006 [0.156]	0.043** [0.035]	0.014 [0.358]
SIZE	-0.007 [0.813]	0.097** [0.015]	0.085** [0.038]
LEVERAGE	0.005 [0.769]	0.023 [0.478]	0.004 [0.817]
FIRM AGE	-0.104 [0.159]	-0.069 [0.719]	-0.072 [0.616]
ROA	-0.007 [0.427]	0.003 [0.840]	-0.017* [0.061]
PROFIT	-0.090** [0.024]	0.006 [0.966]	0.066 [0.143]
SUBS	-0.137 [0.253]	-0.356 [0.175]	-0.736*** [0.001]
CORP	-0.163 [0.246]	-0.015 [0.964]	-0.431* [0.066]
JUDGMENTS	0.185 [0.621]	-0.870** [0.050]	-0.987 [0.135]
BANKRUPTCY	0.456 [0.305]	-0.432 [0.451]	-1.085** [0.032]
FIRM DEFAULT	0.198 [0.108]	-0.845*** [0.008]	-0.606** [0.037]
TRADE CREDIT	-0.004 [0.978]	-0.126 [0.587]	-0.006 [0.974]
RATING (D&B)			0.171*** [0.004]
INDUSTRY DUMMIES	Yes	Yes	Yes
<i>Macroeconomic variables</i>			
PERSONAL INCOME	-0.000 [0.531]	0.000** [0.038]	0.000 [0.149]
UNEMPLOYED	-0.124 [0.233]	-0.028 [0.908]	-0.324* [0.057]
POVERTY	-0.014 [0.791]	0.061 [0.537]	0.171* [0.065]

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ETHNIC POP. RATE	0.860 [0.353]	-0.170 [0.931]	-2.509 [0.122]
λ_1		-2.028 [0.382]	
λ_2			1.229 [0.337]
Constant	4.739*** [0.001]	-4.923 [0.285]	-3.917 [0.159]
Pseudo R ²	0.076	0.161	0.230
Observations	1691	1009	926

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Table A4 – Determinants of loan premium rate without fees, with fees, collateral, and credit availability for RL indicator

Table A4-1: Results for Minorities

These regressions show the impact of Minorities and RL indicators on the loan premium rate (without fees), loan premium rate with fees, personal collateral, firm collateral and credit availability of the last approved credit. In each case, Model 1 contains all control variables except the Mills ratio (added to Model 2). All regressions are robust to heteroscedasticity. Asterisks denote p-values as * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$ (indicated in brackets).

Dependent variable	LPR		LPRF		Collateral		Credit Availability	
	Model (1)	Model (2)	Model (1)	Model (2)	Model (1)	Model (2)	Model (1)	Model (2)
RL	-0.546 [0.265]	-0.528 [0.282]	-0.620 [0.160]	-0.633 [0.152]	-0.528*** [0.000]	-0.532*** [0.000]	0.052 [0.207]	0.050 [0.230]
MINORITY	0.238 [0.757]	0.390 [0.646]	0.337 [0.663]	0.220 [0.797]	-0.024 [0.817]	-0.081 [0.468]	0.046 [0.204]	0.032 [0.357]
RL * MINORITY	4.346** [0.035]	4.501** [0.033]	1.983 [0.161]	1.874 [0.182]	0.370** [0.027]	0.316* [0.085]	-0.099* [0.090]	-0.111** [0.047]
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Owner characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market & macroeconomic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mills ratio		Yes		Yes		Yes		Yes
R ²	0.250	0.252	0.245	0.246	0.321	0.325	0.114	0.118
Adjusted R ²	0.209	0.209	0.204	0.204	0.284	0.287	0.065	0.069
Observations	775	775	775	775	775	775	775	775

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Table A4-2: Results for Minorities

These regressions show the impact of Hisp, AFAM, Asian, and RL indicators on the loan premium rate (without fees), loan premium rate with fees, personal collateral, firm collateral and credit availability of the last approved credit. In each case, Model 1 contains all control variables except the Mills ratio (added to Model 2). All regressions are robust to heteroscedasticity. Asterisks denote p-values as * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$ (indicated in brackets).

Dependent variable	LPR		LPRF		Collateral		Credit Availability	
	Model (1)	Model (2)	Model (1)	Model (2)	Model (1)	Model (2)	Model (1)	Model (2)
RL	-0.577 [0.241]	-0.619 [0.211]	-0.635 [0.155]	-0.677 [0.130]	-0.532*** [0.000]	-0.536*** [0.000]	0.050 [0.226]	0.048 [0.252]
HISP	1.342 [0.411]	1.311 [0.422]	1.333 [0.427]	1.292 [0.440]	-0.185 [0.255]	-0.188 [0.240]	-0.012 [0.581]	-0.013 [0.554]
RL * HISP	7.598* [0.079]	7.646* [0.073]	-0.753 [0.677]	-0.692 [0.706]	0.647*** [0.005]	0.650*** [0.006]	-0.058 [0.204]	-0.056 [0.235]
AFAM	-1.968*** [0.001]	-4.299*** [0.000]	-1.772*** [0.004]	-4.289*** [0.000]	0.269 [0.174]	-0.145 [0.597]	-0.018 [0.568]	-0.101 [0.197]
RL * AFAM	4.354** [0.048]	4.032** [0.030]	3.999* [0.062]	3.674** [0.038]	-0.270 [0.241]	-0.314* [0.075]	0.087 [0.442]	0.077 [0.479]
ASIAN	-0.202 [0.766]	-0.511 [0.460]	-0.179 [0.794]	-0.525 [0.455]	0.070 [0.613]	0.013 [0.925]	0.072 [0.243]	0.060 [0.313]
RL * ASIAN	4.450** [0.023]	4.375** [0.026]	4.986** [0.016]	4.839** [0.018]	0.498** [0.027]	0.479** [0.033]	-0.179** [0.022]	-0.181** [0.021]
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Owner characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market & macroeconomic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mills ratio		Yes		Yes		Yes		Yes
R ²	0.280	0.285	0.262	0.269	0.330	0.335	0.121	0.125
Adjusted R ²	0.235	0.240	0.217	0.224	0.290	0.294	0.068	0.071
Observations	775	775	775	775	775	775	775	775

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Table A4-3: Results for females

These regressions show the impact of Minorities and RL indicator son the loan premium rate (without fees), loan premium rate with fees, personal collateral, firm collateral and credit availability of the last approved credit. In each case, Model 1 contains all control variables except the Mills ratio (added to Model 2). All regressions are robust to heteroscedasticity. Asterisks denote p-values as * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$ (indicated in brackets).

Dependent variable	LPR		LPRF		Collateral		Credit Availability	
	Model (1)	Model (2)	Model (1)	Model (2)	Model (1)	Model (2)	Model (1)	Model (2)
RL	0.558 [0.416]	0.493 [0.473]	-0.116 [0.810]	-0.204 [0.671]	-0.463*** [0.000]	-0.479*** [0.000]	0.043 [0.296]	0.038 [0.369]
FEMALE	0.298 [0.353]	0.288 [0.372]	0.285 [0.377]	0.273 [0.398]	-0.061 [0.336]	-0.062 [0.316]	-0.018 [0.152]	-0.019 [0.144]
RL * FEMALE	-1.553 [0.267]	-1.614 [0.235]	-0.599 [0.586]	-0.676 [0.517]	-0.015 [0.902]	-0.033 [0.786]	-0.027 [0.563]	-0.031 [0.518]
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Owner characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market & macroeconomic variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mills ratio		Yes		Yes		Yes		Yes
R ²	0.217	0.220	0.236	0.240	0.317	0.323	0.109	0.114
Adjusted R ²	0.174	0.175	0.194	0.198	0.280	0.285	0.060	0.064
Observations	775	775	775	775	775	775	775	775

Chapter 2: Borrowing Challenges for Minorities: How Lending Technologies Affect Discrimination in the SME Credit Market

Table A5

Results for the impact of being a minority on the length of relationship

These regressions show the impact of relationship lending technology and the minorities indicators on the length of relationship between the firm and the bank that grants the credit. All results are robust to heteroscedasticity. Asterisks denote p-values as * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$ (indicated in brackets).

Dependent variable	LENGTH
RL	-0.788 [0.958]
HISP	3.725 [0.815]
AFAM	-93.084 [0.209]
ASIAN	17.915 [0.251]
FEMALE	0.292 [0.981]
Control variables	All
R ²	0.306
Adjusted R ²	0.261
Observations	775

Table A6

Results for LPR, LPRF, collateral and availability analysis in function of the length of the relationship

These regressions show the impact of Minorities and Females and the length of relation on the loan premium rate (without fees), loan premium rate with fees, personal collateral, firm collateral and credit availability of the last approved credit. We run this regression only for those who use relationship lending technology. All regressions are robust to heteroscedasticity. Asterisks denote p-values as * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$ (indicated in brackets).

Dependent variable	LPR	LPRF	COLLATERAL	AVAILABILITY	LPR	LPRF	COLLATERAL	AVAILABILITY
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LENGTH	0.018*** [0.001]	0.010* [0.072]	0.001 [0.180]	-0.000 [0.192]	0.009* [0.064]	0.007 [0.180]	0.001 [0.217]	-0.000 [0.813]
FEMALE					-3.167** [0.031]	-1.781 [0.115]	-0.098 [0.449]	-0.048 [0.558]
FEMALE * LENGTH					0.004 [0.671]	-0.004 [0.554]	-0.001 [0.288]	0.000 [0.478]
MINORITY	4.980*** [0.001]	2.709* [0.083]	0.371* [0.052]	-0.141 [0.110]				
MINORITY * LENGTH	-0.047** [0.013]	-0.017 [0.341]	-0.001 [0.605]	0.003* [0.052]				
Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Owner characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mills ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	10.278*** [0.005]	2.330 [0.481]	0.013 [0.973]	0.140 [0.379]	8.916** [0.020]	1.485 [0.638]	-0.132 [0.728]	0.119 [0.521]
R ²	0.768	0.649	0.568	0.668	0.736	0.652	0.533	0.618
Adjusted R ²	0.640	0.465	0.341	0.494	0.591	0.470	0.288	0.417
Observations	91	91	91	91	91	91	91	91

Table A7

Results for LPR, LPRF, collateral and availability analysis in function of the minority population rate in the area

Table A7-1: Results for ethnic minorities

These regressions show the impact of Minorities and RL indicators on the loan premium rate (without fees), loan premium rate with fees, personal collateral, firm collateral and credit availability of the last approved credit. We split our sample in two depending on the mean rate of minorities in the census. All regressions are robust to heteroscedasticity. Asterisks denote p-values as * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$ (indicated in brackets). Last columns (9 to 12) display results for a Chow test where we compare the coefficients.

Dependent variable	Ethnic population rate \leq mean percentage				Ethnic population rate $>$ mean percentage				Chow Test			
	LPR	LPRF	Collateral	Availability	LPR	LPRF	Collateral	Availability	(9)	(10)	(11)	(12)
RL	0.306 [0.643]	0.058 [0.930]	-0.579*** [0.000]	0.007 [0.578]	-1.073* [0.098]	-0.900 [0.128]	-0.506*** [0.000]	0.080 [0.200]				
HISP	-0.686 [0.713]	-0.618 [0.738]	-0.220 [0.301]	0.007 [0.711]	1.331 [0.530]	1.291 [0.549]	-0.080 [0.622]	-0.024 [0.435]				
RL * HISP	11.470*** [0.000]	2.179 [0.269]	0.756*** [0.005]	-0.014 [0.564]	2.150 [0.279]	-2.442 [0.244]	0.575** [0.012]	-0.082 [0.238]	***	*	***	
AFAM	-3.219* [0.057]	-1.589 [0.398]	-0.550 [0.276]	-0.041 [0.247]	-4.186*** [0.010]	-4.691*** [0.002]	-0.175 [0.584]	-0.046 [0.689]	**	***		
RL * AFAM	3.253 [0.109]	2.330 [0.308]	0.328 [0.374]	-0.033 [0.323]	0.597 [0.832]	0.183 [0.947]	-0.627 [0.105]	0.742*** [0.000]	*			***
ASIAN	0.901 [0.280]	0.783 [0.337]	0.376** [0.040]	0.211*** [0.006]	-0.540 [0.588]	-0.483 [0.627]	0.235 [0.165]	-0.051 [0.388]			**	**
RL * ASIAN	8.709*** [0.000]	8.651*** [0.000]	-0.351 [0.304]	-0.212*** [0.009]	3.119 [0.152]	3.292 [0.156]	0.395 [0.142]	-0.119 [0.159]	***	***		*
Control variables	All	All	All	All	All	All	All	All				
R ²	0.438	0.423	0.394	0.564	0.349	0.304	0.454	0.200				
Adjusted R ²	0.334	0.319	0.285	0.485	0.281	0.233	0.398	0.119				
Observations	289	289	289	289	486	486	486	486				

Table A7-2: Results for female

These regressions show the impact of Minorities and RL indicators on the loan premium rate (without fees), loan premium rate with fees, personal collateral, firm collateral and credit availability of the last approved credit. We split our sample in two depending on the mean rate of women in the census. All regressions are robust to heteroscedasticity. Asterisks denote p-values as * $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$ (indicated in brackets).

Dependent variable	Female population rate \leq mean percentage				Female population rate $>$ mean percentage			
	LPR	LPRF	Collateral	Availability	LPR	LPRF	Collateral	Availability
RL	0.208 [0.836]	0.300 [0.771]	-0.672*** [0.000]	-0.033 [0.423]	0.754 [0.402]	-0.161 [0.771]	-0.361*** [0.000]	0.070 [0.208]
FEMALE	0.140 [0.799]	0.140 [0.799]	-0.088 [0.361]	0.021 [0.391]	0.013 [0.972]	0.029 [0.940]	-0.078 [0.345]	-0.029** [0.030]
RL * FEMALE	-3.093* [0.088]	-3.209* [0.078]	0.278 [0.237]	-0.009 [0.853]	-0.494 [0.767]	0.781 [0.522]	-0.161 [0.323]	-0.040 [0.559]
Control variables	All	All	All	All	All	All	All	All
R ²	0.450	0.452	0.497	0.278	0.212	0.264	0.327	0.138
Adjusted R ²	0.353	0.359	0.411	0.154	0.141	0.199	0.267	0.062
Observations	268	268	268	268	507	507	507	507

Chapter 3:
Is trade credit a substitute for relationship
lending credit ?

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Despite its importance to the funding of small enterprises (SMEs), the question of how trade credit is used has not been fully answered. Recently, Uchida *et al.* (2013) showed that trade creditors can act as relationship lenders. To advance this result, we study the use of trade credit as a substitute for relationship lending credit when firms cannot otherwise obtain such credit. Using a sample of SMEs from the Survey of Italian Manufacturing Firms, we show that when opaque firms seeking relationship credit encounter transactional banks, they retain a greater portion of trade credit in their loans. These firms thus substitute trade credit for their missing relationship credit, because trade creditors are better evaluators of firms than are transactional lenders. The results depend on the size and age of the firm, the nature of the bank, and the size of the firm's banking pool.

1 Introduction

Trade credit is one of the most important sources of financing for small- and medium-sized enterprises (SMEs). However, while prior literature recognizes that trade credit's importance depends on the country—the part of trade credit in total asset varies across Europe, from 13.28% (Netherlands) to 42% (Italy) (Giannetti, 2003)—and on the banking system and legal infrastructure (Demirgüç-Kunt and Maksimovic, 2002), it has not yet solved the puzzle of how trade credit gets used.

There are two possible explanations for the use of trade credit. The first is the real operation explanation, composed of theories of cost minimization (Ferris, 1981), quality supervision (Smith, 1987), and price discrimination (Brennan *et al.*, 1988). The second is the financial explanation, composed of all theories about the link between trade credit and financial institutions (e.g., Cook, 1999; Alphonse *et al.*, 2004; Casey and O'Toole, 2014). According to these theories, trade creditors are potential debt suppliers who have the advantage of acquiring private information from the firm through strong relationships (e.g., Biais and Gollier, 1997; Ng *et al.*, 1999; Burkart and Ellingsen, 2004). This advantage enables trade creditors to provide credit to bank-constrained firms, as happened during the financial crisis (Casey and O'Toole, 2014).

Uchida *et al.* (2013) link this notion of private information to the classifications of soft and hard information developed by Stein (2002). Private information can be regarded as qualitative information that is transmitted via multiple contacts between suppliers and clients over time, which Stein (2002) calls soft information. According to Uchida *et al.* (2013), trade creditors accumulate soft information about firms through their relationships with them, acquiring information that is not necessarily the same as that known to banks. The authors point out that long relationships between trade creditors and firms allow firms to have access to the same benefits that relationship lenders provide, that is, credit availability when firms are in a downturn (Cuñat, 2007) and easier access to credit renegotiation (Wilner, 2000). The authors in turn develop a “relationship lending” hypothesis: Trade creditors can be regarded as relationship lenders because they accumulate soft information. Berger and Udell (2006) define two types of relationship lending technologies:

- Transaction-based lending based on borrowers' hard information
- Relationship lending, primarily based on borrowers' soft information

Chapter 3: Is Trade Credit a Substitute for Relationship Lending Credit?

Uchida *et al.* (2013) show that trade creditors can become relationship lenders, depending on their relative bargaining power. When buyers are non-dependent on their trade creditors in terms of purchase amounts, trade creditors exhibit the same behavior as relationship lenders. The strength of the relationship between the firm and its supplier is captured by the current measure of relationship lending (Petersen and Rajan, 1994), that is, the relationship length. These findings in turn raise a question: Can trade credit be a funding substitute for opaque firms that cannot obtain bank relationship credit?

According to Berger *et al.* (2005) and Stein (2002), the optimal match is as follows: More opaque (transparent) firms, which emit mostly soft (hard) information, should borrow from smaller (larger) relationship (transactional) banks because such banks can optimally evaluate the information emitted. But in some cases, changes in the bank organization can cause the banks to switch from being relationship organizations to being transactional organizations, resulting in firm–bank mismatches. We note two explanations for this change. First, Bonaccorsi Di Patti and Gobbi (2007) find that bank mergers affect the structural organizations of banks and change the availability of credit. Second, Hale (2011) proves that during periods of financial crisis, banks drastically reduce their relationships with clients and favor transactional lending technology over relationship lending technology. Another potential explanation for mismatching comes directly from firms and their ability to accurately observe bank organizations: Even if firms have the advantage of using relationships to evaluate bank type, their evaluations are not always reliable. Firms can *misperceive* their financial partners, judging them, for example, to be relationship banks, when they are actually transactional. The consequence of these potential changes is that firms can find themselves in a situation where they can't find another relationship bank, and have no choice than to deal with a transactional bank.

The consequence of such mismatches is that banks cannot correctly analyze the information emitted by firms, resulting in a higher probability of misevaluation of the quality of the firm. This misevaluation has impacts: Ferri and Murro (2015) demonstrate that when opaque firms match with transactional banks, their probability of being credit-rationed increases. De Bodt *et al.* (2015) show that not only must these firms must pay higher interest rates but also have to attract more creditors before banks will evaluate them correctly. To our knowledge, though authors have studied the consequences of mismatching when firms stay with their banks,

researchers have not yet identified a credit *alternative* for firms. We consider the potential for firms to use trade credit as an alternative source of funding.

To test our idea, we examine the tenth wave of the Survey of Italian Manufacturing Firms. This data set presents three main advantages for our analysis: First, it contains accounting information that measures the importance of trade credit to firms' funding. Second, for the first time, it includes a set of questions about bank–firm relationships and perceptions of firms about their banks, allowing us to construct two continuous indicators for lending technology. The first indicator captures the degree of relationship lending, and the second captures the degree of transactional lending. These indicators correspond more closely to reality than previous studies that use discrete measures (i.e., that a bank is relationship or transactional; e.g., Berger and Udell, 2004). Finally, the data set is based on Italian firms; Italy is of interest to us because when bank credit is the most important source of financing in the country for SMEs, trade credit represents an important alternative source of financing—on average 42% of total assets, the highest percentage in Europe (Gianetti, 2003).

Our results show that opaque firms that perceive their banks as transactional have higher levels of trade credit, which empirically confirms our idea that these firms use trade credit as a substitute for relationship lending credit in cases of mismatching. However, this effect holds only for older, larger firms, which have greater capacity for negotiation in comparison with smaller, younger firms. Older, larger, opaque firms increase their proportion of trade credit in cases of mismatching but decrease it when relationship banks evaluate them, because trade credit is more expensive than bank credit when it is correctly evaluated. Finally, we show that firms change their behavior depending on the nature of their banks (national or local) and on the structures of the firms' banking pools.

In Section 2, we provide a survey of trade credit and present our theoretical predictions. In Section 3, we present our data and methodology, and then in Section 4, we report our results. Finally, Section 5 concludes.

2 Related literature and theoretical predictions

Most theories that explain the use of trade credit can be classified in two groups. The first group is composed of theories based on real operations. Ferris (1981) offers the transaction cost minimization theory: Trade credit permits reductions in the cost of delivering multiple goods by assigning unique monthly or quarterly payments. Trade credit also gives firms time to check

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the quality of products (Smith, 1987). Brennan *et al.* (1988) show that creditworthy customers pay promptly to receive any available discounts, while risky customers find the price of trade credit to be attractive relative to other options. Trade credit allows firms to manage their inventories and cash flow more easily and according to their need.

The second group includes theories based on financial advantages. These theories propose that trade creditors have some advantages for granting credit that banks do not. For example, Biais and Gollier (1997) develop a model in which trade creditors sometimes acquire private information more easily than banks. This acquisition allows trade creditors to reduce asymmetric information and offer credit to opaque firms when the banks cannot. In this way, trade credit acts as a substitute for bank-credit-constrained firms. Ng *et al.* (1999), McMillan and Woodruff (1999), Cook (1999) among others find similar results, and researchers such as Cuñat (2007) and Lin and Chou (2015) empirically validate this theory. Other researchers show that substitution also becomes more important as firms increase in age and size (Casey and O'Toole, 2014) because older firms are more dependent on trade credit and have better access to it (Klapper *et al.*, 2012).

Burkart and Elligsen (2004), using the model developed by Biais and Gollier (1997), show that the use of trade credit is not a substitute but a complement to bank credit: With the knowledge that trade creditors acquire and manage more private information than they do, banks regard the granting of trade credit as a signal of firm quality and therefore lend to firms that have trade credit. Alphonse *et al.* (2004) empirically validate this hypothesis. Aktas *et al.* (2012) show that the use of trade credit is positively correlated with the quality of the firm.

Compared with banks, trade creditors also have an advantage in managing collateral (Longhofer and Santos, 2003; Frank and Maksimovic, 2005). The collateral taken by trade creditors—goods sold on credit—has a higher value than the collateral taken by banks, because it is not in the nature of banks to manage these kinds of goods. Moreover, a trade creditor can liquidate the goods more easily than a bank.

Long-term relationships with suppliers also present some advantages. Cuñat (2007) shows that long-term buyer–supplier relationships allow the development of shared informal technology that acts as insurance against liquidity shocks; this technology benefits both parties and cannot be provided by other lenders. This production technology depends on the fraction of trade credit in the total credit of the firm. Long-term relationships also allow firms to renegotiate debt more easily with their sellers (Wilner, 2000). Moreover, industrial organization research (e.g.,

Johnson *et al.*, 2002) shows that trade credit duration affects buyers' payment decisions, such that longer durations lead to credit payments, whereas short durations favor cash payments.

Uchida *et al.* (2013) link all of these theories to relationship lending literature to develop their relationship lending hypothesis. As explained previously, they first compare the private information that trade creditors acquire (e.g., Biais and Gollier, 1997; Burkart and Ellingsen, 2004) with the information defined by Stein (2002) as soft. They show that trade creditors can play exactly the same roles as banks that use relationship lending technology, that is, accumulating and using information. For firms, information production and management generates the same advantages as those generated by relationship lending technology: better access to credit and better credit conditions, even when firms are in a downturn.

Therefore, trade creditors can be relationship lenders in cases of mismatching, and opaque firms may be able to use trade credit as a funding alternative. To avoid being misevaluated and having to increase their numbers of bank creditors, these firms can decide to borrow from their trade creditors, because their trade creditors can evaluate their soft information. If it's the case, we should observe a higher level of trade credit for opaque firms in case of mismatching:

H1: Opaque firms that encounter banks that use transactional lending technology have a higher portion of trade credit than others.

However, trade credit is more expensive than bank credit,³⁰ and when firms are liquidity-unrestricted and have an access to relationship lending technology, they may favor cheaper bank credit over more expensive trade credit (Biais and Gollier, 1997; Burkart and Ellingsen, 2004). That is, opaque firms have no interest in substituting their bank credit with trade credit when they are correctly evaluated; when they encounter face banks that manage soft information, they should have lower trade credit. Indeed, we should observe a lower level of trade credit in this case.

H2: Opaque firms that encounter banks that use relationship lending technology have a lower portion of trade credit than others.

Klapper *et al.* (2012) and Casey and O'Toole (2014) show that larger and older firms use more trade credit than smaller firms when they are bank-constrained. One explanation suggests that

³⁰ A "2/10 net 30" agreement (take 2% discount if the firm pays in 10 days, otherwise pay in 30 days) means an implicit interest rate of 43.9% for firms that do not take the discount (Ng *et al.*, 1999)

because of their size and longer relationships with suppliers, they can negotiate better trade credit conditions than smaller firms. Another explanation comes from Nilsen (2002), who finds that even when firms are large and old, they do not systematically have access to open-market credit. But because they need more credit than their banks can provide, they turn to their trade creditors. If it's true, we should observe a higher level of trade credit only for larger and older opaque firms.

However, Berger and Udell (1995) explain that age can be a proxy for firms' publicly available information, such that opaque firms are transformed into transparent firms. As a firm's age increases, the quantity of information available also increases; the firm can more easily use this information and switch to a transactional banking system when relationship lending is not available. Therefore, the use of trade credit should be more important for smaller, younger firms.

H3a: Larger, older, opaque firms that encounter transactional banks are more likely to have a higher portion of trade credit than smaller, younger firms.

H3b: Smaller, younger, opaque firms that encounter transactional banks are more likely to have a higher portion of trade credit than larger, older firms.

Finally, Berger *et al.* (2005) prove that larger national banks have an advantage in managing hard information and that smaller local banks have an advantage in managing soft information because of their respective decision-making organizational structures. Our *NATIONAL* indicator—which equals 1 if the bank is a national bank and 0 if it is a local bank—reflects the firm's perception of the bank's nature *before* any contact or relationship; it is an *ex ante* measure. Our lending technology indicator is the firm's perception of the bank's nature *after* contact and establishment of some relationship; it represents an *ex post* measure of the bank's nature.

Thus there are two possible cases. In the first, the *ex-ante* and *ex post* measures correspond, such that when an opaque firm deals with a national bank, even if the firm perceives the bank to be transactional *ex post*, the firm does not change its behavior, because that perception is what it expects. In the second case, the measures do not correspond, such that when an opaque firm deals with a local bank that is transactional, the result is a mismatch; the firm substitutes trade credit for bank credit.

H4: Opaque firms have a higher portion of trade credit only when they deal with a local bank that they perceive ex post to be transactional.

3 Methodology and data

3.1 Survey of Italian Manufacturing Firms

The database comes from the 10th wave of the Survey of Italian Manufacturing Firms (SIMF), conducted in 2007 by the UniCredit banking. It contains information about 5,137 Italian manufacturing firms with more than 10 employees. The strength of this database is its extensive information on firms: balance sheets, income statements, ownership structures, numbers and skill degrees of employees, R&D, internationalization and export, and—of greatest interest—information about firm relationships with the banking system and financial management from the point of view of those firms. By having information about a firm’s main bank and its relationship with that bank, from the point of view of the firm, we can analyze a firm’s choices according to what it *perceives*, rather than according to reality. For a complete description of the data set, see Bartoli *et al.* (2013). We also use information from the Italian National Statistics Office (ISTAT) and from Aiello and Bonanno (2015) to complete our database with macroeconomic variables.

Our sample is composed of 971 firms; Table A1 in the Appendix presents the descriptive statistics (mean and standard deviation). On average, firms have 30 years of existence and 167 employees. The large majority of firms are corporations (96.6%), and more than one-quarter belong to a group or consortium. On average, firms have relationships with 5–6 banks and a relationship length of about 17 years with their main bank, which in about 35% of cases is national.

3.2 Methodology

To test our hypotheses, we use the following model:

$$y_i = \alpha + \beta * soft_i + \gamma * LT_i + \delta * (soft_i * LT_i) + \theta * control + \varepsilon_i , \quad (1)$$

where:

- y_i is the importance of trade credit in firm funding;

- $soft_i$ is a measure of the opaqueness of the firm through the use of soft information during the credit application;
- LT_i is the lending technology used to finance the firm, such that it captures the quantity of soft and hard information managed;
- $soft_i * LT_i$ is the interaction term between those variables;
- $control$ is a vector of control variables; and
- ε_i a vector of heteroskedastic-robust standard errors.

3.3 Variables

3.3.1 Trade credit, lending technology, and soft information

We seek to explain the use of trade credit by the type of information used by the firm and the lending technology used by the bank. The use of trade credit can be divided into two terms: quantity and duration. As a measure of the quantity of trade credit, we use three possible proxies:

- TC/TL, which is the ratio of the amount of trade credit to the total loan for the firm at the end of December 2006;
- TC/TA, which is the ratio of the amount of trade credit to the total assets for the firm at the end of December 2006; and
- TC/STL, which is the ratio of the amount of trade credit to total outstanding short-term loans at the end of December 2006.

As a measure of the duration of trade credit, we use the days payable outstanding (DPO). This ratio measures how long it takes for the firm to pay its invoices from its suppliers, equal to:

$$DPO = \frac{\text{average trade payable}_{2006}}{\text{cost of goods sold}_{2006}} * 360.$$

The higher the ratio, the more important it is that the firm is liquid. Because all our dependent variables are continuous variables, we use ordinary least square models in all cases.

With regard to lending technology, we use the methodology of Bartoli *et al.* (2013) to develop two indicators: one for transactional lending technology (LT_TRANS) and one for relationship lending technology (LT_REL). To capture what kind of lending technology firm respondents believe their banks use, we ask, “In your view, what criteria does your bank follow in granting loans to you?” Firm respondents must provide a weight of 1 (very much) to 4 (nil) for 15 items.

Table 1 displays the items, the distribution of the answers for each item, and the manner in which each item is classified in the construction of the indicators.

The respondents believe the most important criteria are accounting criteria: Approximately 20% of the sample chose 1 (very important) for criteria 1–4, whereas other items were chosen by about 10% of the sample. Thus, firm respondents believe that banks use more accounting information than other information.

Table 1: Items used to construct our lending technology indicators

This table displays the 15 items used to answer to the question “*In your view, what criteria does your bank follow in granting loans to you?*” the distribution of the answers for each item from 1 (very important) to 4 (nil), and how each item is classified to construct the lending technology indicators, i.e., relationship (R) or transactional (T).

Items	1	2	3	4	T/R
1. Ability of the firm to repay its debt (e.g., years needed to repay its debt)	20.39%	44.73%	8.55%	25.33%	T
2. Financial solidity of the firm (capital/asset ratio)	20.29%	47.37%	7.11%	25.23%	T
3. Firm’s profitability (current profits/sales ratio)	18.23%	44.80%	10.09%	26.88%	T
4. Firm’s growth (growth of sales)	18.74%	41.92%	13.59%	25.75%	T
5. Ability of the firm to post real estate (not personal) collateral	9.89%	41.40%	18.64%	30.07%	T
6. Ability of the firm to post tangible non-real estate collateral	8.24%	42.43%	18.54%	30.79%	T
7. Support by a guarantee association (e.g., loan, export, R&D)	13.18%	31.31%	15.14%	40.37%	
8. Personal guarantees by the firm’s manager or owner	11.33%	46.14%	9.27%	33.26%	T
9. Managerial ability on the part of those running the firm’s business	12.46%	49.02%	11.12%	27.39%	R
10. Strength of the firm in its market (number of customers, commercial network)	10.71%	44.49%	15.65%	29.15%	R
11. Intrinsic strength of the firm (e.g., ability to innovate)	14.93%	44.59%	13.18%	27.29%	R
12. Firm’s external evaluation or its evaluation by third parties	10.61%	44.39%	16.27%	28.73%	
13. Length of the lending relationship with the firm	11.33%	48.20%	13.29%	27.19%	R
14. Loans granted when the bank is the firm’s main bank	11.33%	50.98%	9.17%	28.53%	R
15. Fiduciary bond between the firm and the credit officer at your bank	11.49%	49.54M	11.12%	25.85%	R

With regard to transactional lending technology, Berger and Udell (2006) consider six possible transaction-based lending technologies: financial statements, small business credit scoring, asset-based lending, factoring, fixed-asset lending, and leasing. Unfortunately, the survey provides information for only three of these technologies: financial statements (items 1–4), real estate (item 5), and other fixed assets (items 6–8). We construct an aggregate variable (LT_TRANS), equal to the average of seven dummy variables, which takes a value of 1 if the firm assigned a value of 1 to the previous lending items. The higher the variable, the more the firm regards its bank as transactional.

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With regard to relationship lending technology, Berger and Udell (2006) explain that it is primarily based on soft information and developed through contact over time. It represents qualitative information about the firm, such as manager reliability or the intrinsic strength of the firm (Stein, 2002). We focus on all items that can correspond to one of these characteristics: items 9, 10, 11, 13, 14, and 15. The aggregate variable (LT_REL) is equal to the average of six dummy variables and takes a value of 1 if the firm respondent answers 1 in response to the lending items.

We construct our indicator of opaqueness by capturing the emission of soft information by the firm during the credit application, using a methodology similar to that adopted by Uchida *et al.* (2012) and Bartoli *et al.* (2013). We assume that the firm, knowing whether it emits soft information, chooses its bank accordingly. Therefore, we ask, “Which characteristics are key in selecting your main bank?” Firm respondents must provide a weight ranging from 1 (very important) to 4 (nil) for 14 items, as detailed in Table 2.

Table 2: Items used to construct our soft indicator

This table displays the 14 items used to answer to the question “Which characteristics are key in selecting your main bank?” and the distribution of the answer for each item, from 1 (very important) to 4 (nil).

Items	1	2	3	4
1. The bank knows you and your business.	25.64%	45.21%	4.12%	25.03%
2. The bank knows a member of your Board of Directors or the owners of the firm.	13.49%	52.63%	7.83%	26.06%
3. The bank knows your sector.	14.83%	51.80%	8.65%	24.72%
4. The bank knows your local economy.	11.74%	55.61%	7.93%	24.72%
5. The bank knows your relevant market.	9.37%	54.58%	9.99%	26.06%
6. You have frequent contacts with the credit officer at the bank.	14.93%	50.26%	9.99%	24.82%
7. The bank takes quick decisions.	18.33%	44.70%	12.77%	24.20%
8. The bank offers a large variety of services.	18.23%	49.33%	8.14%	24.30%
9. The bank offers an extensive international network.	14.62%	44.90%	14.11%	26.36%
10. The bank offers efficient internet-based services.	12.67%	46.24%	14.32%	26.78%
11. The bank offers stable funding.	11.74%	47.27%	13.08%	27.91%
12. The bank offers funding and services at low cost.	13.80%	43.36%	14.52%	28.32%
13. The bank’s criteria to grant credit are clear.	13.70%	46.04%	14.62%	25.64%
14. The bank is conveniently located.	16.48%	46.76%	11.23%	25.54%

The most important characteristics for the firm is the first item: “The bank knows you and your business” (25.64% of the sample). This finding reveals the importance, to the firm, of its

relationship with its bank. The two next most important characteristics are the seventh and the eighth items (respectively, 18.33% and 18.23%); both show that one of the first preoccupations of customers is to not lose time with banks. They want a quick-acting bank that can provide all the services they want.

To construct our indicator, we choose two items:

1. The bank knows you and your business.
6. You have frequent contacts with the credit officer at the bank.

The variable *SOFT* is a dummy that takes the value of 1 if the firm respondent answers 1 for both these items. In our sample, 8.65% of firms use mostly soft information when they conduct business with their banks.

Table A2 in the Appendix displays the correlation matrix between our dependent variables and our lending technology and information indicators. Except for the DPO, our lending technology and soft indicators never correlate with our dependent variables. In the case of DPO, correlations are positive and significant with our *SOFT* and *LT_REL* indicators. With regard to the lending technology and information indicators, the indicators *LT_TRANS* and *LT_REL* are significantly and positively correlated, a result that supports Bartoli *et al.*'s (2013) finding that relationship and transactional lending technologies are complementary. Finally, the emission of soft information is correlated with the perception of type of bank (transactional or relationship).

3.4 Control variables

We include three additional types of control variables: bank controls, firm controls, and macroeconomic controls. For the bank variables, we define a dummy, *NATIONAL*, equal to 1 if the main bank is a national bank or a foreign bank, and 0 if the main bank is a smaller mutual bank, larger-sized cooperative bank, savings bank, or other type of bank. For the firm variables, we control for several characteristics:

- Firm quality, using the leverage and the profit of the firm.
- Portion of firm's total assets that are fixed assets (*FA/TA*) and *AUDIT*, equal to 1 if the firm has a certified accounting statement (potential hard information emitted).
- Firm size, using the logarithm of the firm age and the logarithm of the number of employees.

- Firm's relationship with financial institutions, controlling for the logarithm of the number of institutions the firm deals with, $\text{Log}(\text{Bank})$; the distance between the firm and its main bank, Distance ; the length of relationship between them, Rel. Length ; and whether the firm has already been rationed by its bank, Credit Rationed .
- Whether the firm belongs to a group or a consortium, using two dummies GROUP and CONSORTIUM that equal 1 if they belong (membership can represent an alternative source of funding).
- Firm's legal form, using the dummy variable, CORPORATION , equal to 1 if the firm is a Corporation.
- Firm's geographic location, using a dummy variable for each of the 101 provinces in Italy.
- Firm's sector, including a dummy variable for each of the six sectors represented in the database: agriculture, wholesale, construction, industrial production, service, and transport.

The final group of control variables is composed of macroeconomic variables. First, we control for the economic environment and investment opportunities using the gross domestic product (GDP) of the province in which the firm is located (Niskanen and Niskanen, 2006) and the loans/deposit ratio, which is a proxy for the traditional function of banks, that is, the transformation of deposits into loans (Aiello and Bonanno, 2015). The higher the ratios, the better the economy, and the higher the opportunities for investment. Second, we include banking sector variables in the Herfindahl-Hirschman index, based on the number of branches per bank in every province, to control for bank competition that can impact the use of trade credit (Demirgüç-Kunt and Maksimovic, 2002). Third, to control for judicial efficiency, we add the number of civil suits pending in each judicial district in Italy (Herrera and Minetti, 2006); more of civil suits implies a more inefficient legal system (Bianco *et al.*, 2005).

4 Results

4.1 Trade credit, opaque firms, and matching

Tables A3, A5, A7, and A9 provide results about the determinants of trade credit for the dependent variables TC/TL , TC/TA , TC/STL , and DOP , respectively.

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The interaction term $SOFT * LT_TRANS$ is positive and highly significant (Column 1) for all dependent variables; neither LT_REL nor LT_TRANS are significant. When faced with transactional banks, opaque firms, emitting mostly soft information, have more trade credit in their loans than others. But for firms that use hard information, it does not change whether they encounter relationship or transactional banks. This finding confirms our first hypothesis: In cases of mismatching, in which opaque firms encounter transactional banks, they substitute trade credit for bank credit. The finding also supports the hypothesis of Uchida *et al.* (2013) that trade creditors can exhibit the same behavior as relationship lenders.

As explained previously, our transactional indicator (LT_TRANS) is composed of three technologies: financial statements, real estate, and other fixed assets. We decomposed our transactional indicator into three sub-indicators, LT_FS , LT_RE , and LT_OF ; respectively, they capture each previous technology. In Columns 2–5, we test Equation 1, replacing our transactional indicator by each sub-indicator, first separately and then together, to determine whether the substitution is the same for all technologies. Firms substitute their bank loans only when they think their bank manages their financial statement technology (Columns 2 and 5 in Tables A3 and A7) and real-estate technology (Columns 3 and 5 in Tables A3, A5, and A9) but not their fixed-asset technology (Columns 4 and 5 in Tables A3, A5, A7, and A9).

Do opaque firms reduce their quantity or duration of trade credit when they are correctly evaluated? We find only weak evidence. The interaction term $LT_REL * SOFT$ is negative and significant; neither LT_REL nor LT_TRANS is significant (Columns 1 and 5, Table A3), but this is the case only with our dependent variable TC/TL . Therefore, opaque firms in good matches have less trade credit in their total loans, but not for other dependent variables.

To check the robustness of our results, we create two more lending technology indicators: $MAINTRANS$ and $MAINREL$, which capture the main lending technology used by the bank (see Table A1 for a description). Table A11 displays the results of our analysis³¹. We can note that when the technology used is mainly transactional, opaque firms present a higher portion of trade credit than others (columns 1, 3 and 4). This comfort our first hypothesis.

Interestingly, when it's the relationship technology which is mainly used, opaque firms have a lower portion of trade credit than others (all columns) which finally comfort our second hypothesis.

³¹ To conserve space, we don't include all control variables in the table, but results are available to any request.

4.2 *Subsample analysis: credit availability vs. public information and perception*

Our third hypothesis relates to the question of substitution depending on the size and the age of the firm. We seek to determine whether size and age are proxies for credit availability or public information diffusion. To test this hypothesis, we split our sample according to firm size, (number of employees in the firm) and age. We then run Equation 1 for each sub-sample.

Tables A4, A6, A8, and A10 provide the results for TC/TL , TC/TA , TC/STL , and DPO , respectively. In Columns 1 and 2, we split our sample based on the mean number of employees in the sample (138 employees). In Columns 3 and 4, we split the sample according to mean firm age in the sample (30 years).

We find that only older, larger, opaque firms have more trade credit than bank credit in cases of mismatching: The interaction term $SOFT * LT_TRANS$ is positive and significant in Column 2, whatever the dependent variable, but not in Column 1. This finding confirms H3a, because older, larger firms are more dependent on trade credit and have better access to it. For each dependent variable, the interaction term $SOFT * LT_REL$ also is significant and negative for older, larger firms. These firms have better access to bank credit and can more easily substitute relationship bank credit for trade credit, whereas younger, smaller firms must continue to use trade credit. Therefore, H2 is valid only for older, larger firms.

Our final hypothesis relates to the question of a firm's ex ante versus ex post perceptions of the nature of their bank. Do firms change their behavior if their perception ex ante does not correspond to the ex post reality, leading to mismatches? To answer this question, we split our sample according to the variable $NATIONAL$, which represents the ex-ante perception of the nature of the bank by the firm. We then estimate Equation 1 on each subsample. Columns 5 and 7 of Tables A4, A6, A8, and A10 show the results for national and local banks, respectively. The interaction term $SOFT * LT_TRANS$ is positive and significant only when the firm is faced with a local bank, for dependent variables that measure the quantity of trade credit (TC/TL , TC/TA , TC/STL) but not for the DPO . Opaque firms have more trade credit than bank credit in cases of mismatching only if their bank is local. These results show that firms can make mistakes in their ex ante perception of banks, leading to non-intentional mismatching (cf. intentional mismatching when opaque firms go to a national bank), and that they substitute trade credit for bank credit, but others do not. Even when national (local) banks have an advantage

in managing hard (soft) information, we have some evidence of local banks managing hard information.

4.3 Control variables

With regard to our first control variable, firm characteristics, we find that the older the firm, the greater the importance of trade credit to firm funding. This result confirms the finding of Casey and O'Toole (2014) that older firms are more reliant on trade credit than younger firms. Because leverage negatively affects the amount of trade credit, the better the quality of the firm, the higher the portion of bank credit in the total loan.

Our macroeconomic variable, banking competition *HHII*, is positive and significant; the higher the concentration, the higher the use of trade credit, consistent with results found by Demirgüç-Kunt and Maksimovic (2002). With regard to our measure of economic investment opportunities, both the variables *Loans/Deposit* and *GDP* are positive and significant. The greater the investment opportunities, the greater the use of trade credit. This result may seem unexpected,³² but Niskanen and Niskanen (2006) show that high investment opportunities lead to more need for credit than banks can provide; in such conditions, firms also use trade credit.

Finally, with regard to legal system efficiency, the greater the inefficiency of the legal system, the greater the use of trade credit; the variable *Civil suits* is positive and significant. This result is consistent with theory that indicates when the legal system is inefficient and does not protect the banks, the use of bank credit decreases and the use of external funding increases (Demirgüç-Kunt and Maksimovic, 2002).

With regard to the number of bank institutions, we find that the coefficient is negative and significant with regard to the impact on *TC/TL* (Table A3) and on *DPO* (Table A9). With more banks, the use of trade credit declines (in terms of quantity or duration). One potential explanation for this finding is that a greater number of bank partners leads to greater credit availability for firms, because firms can more easily approach different banks, thereby reducing the use of trade credit. However, does the number of banks in a firm's pool have the same impact in cases of mismatching? De Bodt *et al.* (2015) show that a potential consequence of mismatching is the increase in the number of banks approached by firms, to find other banks

³² The common view is that a high investment opportunity is often associated with better availability of bank credit, leading to less use of external funding (Huyghebaert, 2006).

that are able to evaluate them correctly. But what happens when a firm already has a large pool of banks? To test this idea, we split our sample in two subsamples based on number of banks and run Equation (1) on each subsample. Table A12 provides the results. Columns 1–4 correspond to the results for each dependent variable (TC/TL , TC/TA , TC/STL , and DPO , respectively) for subsamples in which firms have pools of three banks or less, and Columns 5–8 display results in which firms have pools of more than three banks.

The interaction term $SOFT * LT_TRANS$ is positive and significant only when the firm has a pool of three banks or fewer (Columns 1–4). That is, only opaque firms with a small pool of banks increase their portion of trade credit, because they substitute trade credit for relationship credit in cases of mismatching. This result supports our idea that opaque firms with large banking pools favor credit from other banks over trade credit.

5 Endogeneity of mismatch and trade credit

We are aware that our estimation may be affected by a potential endogeneity problem. We assume that opaque firms, which are in case of mismatching, increase their level of trade credit to avoid to be misevaluated or to have to increase their number of creditors. However, the level of trade credit can also drive the relation between the firm and its bank. Opaque firms with a high level of trade credit can decide either not to emit soft information, due to its cost, or can be less careful in their bank choice. The direction of this bias being unclear, we deal with this potential endogeneity using an instrumental variable regression.

In our approach, we need to endogenize both our soft indicator and our lending technology indicators.

To endogenize our soft indicator, we use two instruments: an index of self-confidence of the firm and the length of relationship between the firm and its bank. The index of self-confidence is an average of the dummies constructed on the characteristics 7, 8, 9, 10, 11, 12 and 14 from the question “*In your view, which criteria does your bank follow in granting loans to you?*” (Ferri and Murro, 2015). As explained by the authors, this variable captures “the importance that a firm places on the ex-ante transactional features of its bank”. This means that the higher this variable, the lower the firm needs to emit soft information, since it thinks that even without it, it will obtain the credit. Our second instrument is the length of relationship between the firm and its bank, it’s not established that the longer is the length of relationship, the more important

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is the emission of soft information by the firm (Petersen and Rajan, 1994; Degryse and Ongena, 2007; among others).

For our lending technology indicators, we use four instruments: Banks' M&A, Loan Officer Turnover, Functional Distance (Alessandrini *et al.*, 2010) and the mean degree of transactional at a province level. As explained previously, banks' M&A (*Banks' M&A*) lead to change the strategy of the bank, therefore a high level of M&A in the province implies high potential changes in the structure of the bank and could lead to mismatching. The second instrument variable is Loan Officer Turnover (*L.O. Turnover*). Hertzberg *et al.* (2010) show that a rotation policy of loan officers in a bank changes the behavior of these loan officers and the information that they use – they focus more on hard information than soft information –, in this way, whatever the perception of the bank by the firm, if the bank decides to change its rotation policy, this could lead to a change in the information used and so a potential mismatching. We also use the *Functional Distance* between hierarchical levels for the banks in the same province of the firm. This variable is equal to the number of branches operating in the province, each weighted by the logarithm of one plus the kilometric distance between the capital of that province and the capitals of provinces where parent banks are headquartered (Alessandrini *et al.*, 2010). A high functional distance leads to deteriorate the potential use of soft information by the bank so can lead to a change in the lending technology used by the bank. And finally we use the mean degree of transactional at a province level (*Provincial LT_TRANS*), this variable is used to capture potential local effect on the technology used by the bank (Caprio *et al.*, 2007). See Table A1 for a complete description of these variables.

Table A12 displays our results. The first part of the table reports results concerning our three endogenous variables. We can note that an important loan officer turnover leads to increase the probability that the bank use hard information, but decrease the use of soft information. Which is consistent with Hertzberg *et al.* (2010) results. Bank's M&A also impact negatively the use of hard information. Concerning our soft indicator, the length of relationship impact positively the emission of soft information, which is consistent with previous results. Surprisingly, if the Self-Confident index impact the use of soft information, the impact is positive.

Now, if we turn to the second part of the table, we can note that our interaction indicator *SOFT*LT_TRANS* is positive in all columns and significant in columns 1, 3 and 4. This means that the opaquer the firm, the stronger the effect of transactional on the use of trade credit. Interestingly, our interaction indicator *SOFT*LT_REL* which is only significant in case of

TC/TL is here negative and significant in all columns: the opaquer the firm, the more negative is the impact of relationship on the use of trade credit. Therefore, our results are robust to any endogeneity problem.

6 Conclusion

The motivation of firms to use trade credit has been an important puzzle in finance. There are currently two main explanations: real operations and financial. This study is part of the latter group, pertaining to the strength of firm–supplier relationships formalized by Uchida *et al.* (2013), who show that trade creditors can act as relationship lenders. With this article, we go a step further to ask whether trade credit can substitute for relationship credit when firms cannot otherwise find such credit. Using an Italian database, we find strong evidence that opaque firms that use soft information, faced with transactional banks, have greater portions of trade credit in their global debt. Trade creditors, acting as relationship lenders, are better able to evaluate firms than transactional banks and offer better credit conditions; opaque firms, mismatched with their banks, substitute trade credit for bank credit. Although we find only weak evidence overall that these firms decrease their portions of trade credit when they face relationship banks, as their age or size increase, their probability of reducing their portions of trade credit becomes significant. Older, larger firms may have better access to bank credit; they may more easily substitute bank credit for trade credit when their banks do not correctly evaluate them. Moreover, we do not find any notable results for firms that produce hard information. Our results hold only for larger, older opaque firms, confirming Klapper *et al.*'s (2012) results with regard to opaque firms that encounter national banks. The findings support the idea that firms can make mistakes in their perceptions of the nature of their banks. Finally, we show that when opaque firms have a small pool of banks, they prefer to search that pool first, before approaching trade creditors.

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Table A1
Descriptive Statistics

The table shows the mean and standard deviation of each variable for a sample of firms in SIMF 2006

Variable	Description	Mean	Std. Dev.
<i>Dependent variables</i>			
TC/TL	Ratio of firm's trade credit to total loans as of the end of December 2006	0.203	0.199
TC/TA	Ratio of firm's trade credit to total assets as of the end of December 2006	0.226	0.247
TC/STL	Ratio of firm's trade credit to total short-term loans as of the end of December 2006	0.433	0.454
DPO	Days payable outstanding (average trade payable/cost of goods sold) * 360	85.55	92.78
<i>Variables of interest</i>			
SOFT	We use the following question of the Survey: "Which characteristics are key in selecting your main bank?" In answering this question, the firm was required to give a value, with descending order of importance, from 1–4, to the two following characteristics (among others): "The bank knows you and your business" and "You have frequent contacts with the credit officer at the bank." The variable Soft is a dummy that takes value one if the firm chose the highest value for both the above two characteristics. (Bartoli <i>et al.</i> , 2013).	0.086	0.281
LT_TRANS	Global index for transactional lending technology; we use a question available in the Survey: "In your view, which criteria does your bank follow in granting loans to you?" In answering this question, the firm was required to give a weight, from 1 (very much) to 4 (nil) to 15 factors. LT_TRANS, is an average of six dummy variables that take a value of 1 if the firm answered "1" to lending factors 1, 2, 3, 4, 5, 6, and 8 respectively. (Bartoli <i>et al.</i> , 2013).	0.130	0.241
LT_FS	Index for financial statement technology; LT_FS is an average of four dummy variables that take a value of 1 if the firm answered "1" to lending factors 1, 2, 3, and 4 respectively (same question as LT_TRANS).	0.194	0.312
LT_RE	Index for real estate technology; LT_RE is a dummy equal to 1 if the firm answered "1" to lending factor 5 (same question as LT_TRANS).	0.099	0.299
LT_OF	Index for other fixed-asset technology; LT_OF is an average of four dummy variables that take a value of 1 if the firm answered "1" to lending factors 6 and 8 (same question as LT_TRANS).	0.098	0.239
LT_REL	Index for relationship lending technology; we use a question available in the Survey: "In your view, which criteria does your bank follow in granting loans to you?" In answering this question, the firm was required to give a weight from 1 (very much) to 4 (nil) to 15 factors. LT_REL, is an average of six dummy variables that take a value of 1 if the firm answered "1" to lending factors 9, 10, 11, 13, 14, and 15 respectively. (Bartoli <i>et al.</i> , 2013).	0.124	0.259

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MAINTRANS	1 if LT_TRANS is larger than the 75% percentile of the distribution and LT_REL is lower than 75%	0.339	0.474
MAINREL	1 if LT_REL is larger than the 75% percentile of the distribution and LT_TRANS is lower than 75%	0.042	0.201
Control variables			
<i>Firm variables</i>			
LEVERAGE	Ratio of firm's total loan to total asset as of the end of December 2006/1,000	0.025	0.774
Firm Age	Log(1 + firm age)	3.189	0.758
PROFIT	Log(1+ Profit of the firm as the end of December 2006)	8.958	1.924
FA/TA	Ratio of firm's fixed assets to total assets as the end of December 2006	0.279	0.183
Firm Size	Log(1 + firm number of employees)	3.869	1.317
CORPORATION	1 if the firm is a corporation	0.966	0.181
GROUP	1 if the firm belongs to a group	0.256	0.436
CONSORTIUM	1 if the firm is member of a consortium	0.034	0.181
AUDIT	1 if the firm has certified accounting statement	0.243	0.429
Credit Rationed	Dummy takes a value of 1 if the firm answers "yes" to the question "In 2006 would your firm have wished a larger amount of loans at the prevailing interest rate agreed with the bank?" and "yes" to at least one of the following two questions: "In 2006, did the firm demand more credit than it actually obtained?" and/or "To obtain more credit, were you willing to pay a higher interest rate?" (Survey of Italian Manufacturing Firms)	0.063	0.243
Rel. Length	Log(1 + length of the relationship between the firm and the bank)	2.717	0.677
Log(Bank)	Log(1 + number of banks the firm deals with)	1.748	0.492
Province	Set of dummies for each Italian province (in Italy there are 110 provinces)		
Sector	Set of dummies equal to 1 if the firm belongs one of six sectors: agriculture, wholesale, construction, industrial production, service, transport		
<i>Bank variables</i>			
NATIONAL BANK	1 if the main bank is either a national bank or a foreign bank; 0 if the main bank is a smaller-sized cooperation mutual bank, a larger-sized cooperative banks, a saving bank, or other type of bank	0.352	0.478

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Macroeconomic variables

GDP	Log of the value of the GDP in the province as of the end of December 2006	10.222	0.182
HHI1	Hirschman-Herfindahl index calculated using the number of branches per bank in every province	0.099	0.037
Loans/Deposit	Ratio of deposits in loans at provincial level	1.919	0.570
Civil suits	Average number of civil suits pending in the judicial district in 1998–2000, per 1,000 inhabitants (Herrera and Minetti, 2006)	3.455	5.451
Observations	971		

Table A2
Correlation Matrix

The table provides the pairwise correlation matrix. The number in brackets indicates the p-value of the test of significance: * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

	TC/TL	TC/TA	TC/STL	DPO	SOFT	LT_REL	LT_TRANS
TC/TL	1.0000 [0.0000]						
TC/TA	0.9344*** [0.0000]	1.0000 [0.0000]					
TC/STL	0.9451*** [0.0000]	0.8810*** [0.0000]	1.0000 [0.0000]				
DPO	0.7994*** [0.0000]	0.7945*** [0.0000]	0.7693*** [0.0000]	1.0000 [0.0000]			
SOFT	0.0214 [0.5051]	0.0110 [0.7313]	0.0133 [0.6805]	0.0811** [0.0116]	1.0000 [0.0000]		
LT_REL	0.0346 [0.2814]	0.0335 [0.2964]	0.0394 [0.2209]	0.0579* [0.0720]	0.2062*** [0.0000]	1.0000 [0.0000]	
LT_TRANS	0.0379 [0.2379]	0.0384 [0.2317]	0.0480 [0.1364]	0.0512 [0.1117]	0.1922*** [0.0000]	0.6404*** [0.0000]	1.0000 [0.0000]

Table A3

Determinants of the Portion of Trade Credit in Total Loan

These regressions show the impact of the use of soft information and of lending technologies, divided into four indicators, on the quantity of trade credit in total loan. We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	(1)	(2)	(3)	(4)	(5)
	TC/TL	TC/TL	TC/TL	TC/TL	TC/TL
SOFT	-0.051 [0.117]	-0.059 [0.108]	-0.023 [0.474]	-0.032 [0.319]	-0.051 [0.150]
LT_REL	0.013 [0.780]	0.041 [0.318]	-0.001 [0.986]	0.007 [0.870]	0.026 [0.581]
SOFT * LT_REL	-0.237* [0.077]	-0.087 [0.387]	-0.114 [0.264]	-0.046 [0.665]	-0.249* [0.067]
LT_TRANS	-0.001 [0.980]				
SOFT * LT_TRANS	0.378*** [0.007]				
LT_FS		-0.033 [0.309]			-0.045 [0.187]
SOFT * LT_FS		0.176* [0.061]			0.181** [0.049]
LT_RE			0.019 [0.517]		0.030 [0.358]
SOFT * LT_RE			0.197** [0.020]		0.163* [0.080]
LT_OF				0.010 [0.832]	0.008 [0.874]
SOFT * LT_OF				0.128 [0.219]	0.028 [0.798]
Credit Rationed	0.000 [0.990]	-0.004 [0.879]	0.003 [0.918]	0.002 [0.956]	-0.001 [0.967]
AUDIT	0.003 [0.859]	0.005 [0.750]	0.002 [0.880]	0.003 [0.858]	0.004 [0.818]
Log(bank)	-0.027* [0.099]	-0.027 [0.112]	-0.029* [0.080]	-0.026 [0.116]	-0.029* [0.080]
Rel. Length	-0.005	-0.008	-0.004	-0.005	-0.006

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Firm Age	[0.669] 0.038***	[0.523] 0.038***	[0.740] 0.037***	[0.668] 0.038***	[0.620] 0.038***
PROFIT	[0.001] 0.002	[0.001] 0.002	[0.001] 0.002	[0.001] 0.002	[0.001] 0.002
FA/TA	[0.648] 0.038	[0.620] 0.040	[0.715] 0.034	[0.623] 0.040	[0.700] 0.034
Firm Size	[0.298] -0.004	[0.279] -0.004	[0.355] -0.003	[0.277] -0.004	[0.362] -0.003
LEVERAGE	[0.659] -0.011***	[0.598] -0.011***	[0.740] -0.011***	[0.580] -0.011***	[0.732] -0.011***
CORPORATION	[0.000] 0.050	[0.000] 0.046	[0.000] 0.052	[0.000] 0.044	[0.000] 0.054
GROUPE	[0.180] -0.020	[0.215] -0.019	[0.163] -0.022	[0.227] -0.020	[0.148] -0.020
CONSORTIUM	[0.262] -0.020	[0.289] -0.017	[0.229] -0.025	[0.281] -0.015	[0.282] -0.023
NATIONAL BANK	[0.600] 0.015	[0.661] 0.014	[0.518] 0.016	[0.697] 0.014	[0.555] 0.016
GDP	[0.340] 0.917**	[0.377] 0.895**	[0.319] 0.934**	[0.380] 0.908**	[0.301] 0.935**
HHI1	[0.022] 16.569***	[0.026] 16.516***	[0.021] 16.841***	[0.023] 16.071***	[0.022] 17.358***
Loans/Deposit	[0.002] 0.560***	[0.002] 0.566***	[0.002] 0.570***	[0.003] 0.546***	[0.001] 0.588***
Civil Suits	[0.000] 82.448***	[0.000] 83.311***	[0.000] 83.785***	[0.000] 84.928***	[0.000] 82.751***
Province Indicators	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes
Sector Indicators	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes
Constant	-12.447*** [0.007]	-12.219*** [0.008]	-12.663*** [0.006]	-12.279*** [0.007]	-12.755*** [0.006]
Observations	971	971	971	971	971
R ²	0.146	0.142	0.145	0.140	0.149
Adjusted R ²	0.024	0.018	0.022	0.016	0.022

Table A4

Determinants of the Portion of Trade Credit in Total Loan in Subsamples

These regressions show the impact of the use of soft information and of lending technologies on the quantity of trade in total loan in subsamples based on the number of employees (Columns 1 and 2), age (Columns 3 and 4) and bank type (Columns 5 and 6). We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	By number of employees		By firm age		By bank type	
	≤ mean	> mean	≤ mean	> mean	National	Local
	(1)	(2)	(3)	(4)	(5)	(6)
	TC/TL	TC/TL	TC/TL	TC/TL	TC/TL	TC/TL
SOFT	0.010 [0.848]	-0.094** [0.033]	0.076 [0.303]	-0.116*** [0.002]	-0.050 [0.296]	-0.053 [0.306]
LT_REL	0.044 [0.581]	-0.002 [0.980]	-0.018 [0.785]	0.013 [0.838]	-0.065 [0.379]	0.038 [0.598]
SOFT * LT_REL	0.077 [0.683]	-0.325*** [0.006]	0.098 [0.604]	-0.366*** [0.001]	-0.152 [0.458]	-0.216 [0.203]
LT_TRANS	0.064 [0.394]	-0.061 [0.379]	0.091 [0.233]	-0.038 [0.552]	0.078 [0.362]	-0.047 [0.457]
SOFT * LT_TRANS	-0.076 [0.714]	0.595*** [0.000]	-0.178 [0.405]	0.689*** [0.000]	0.275 [0.208]	0.425** [0.015]
Credit Rationed	0.040 [0.307]	-0.016 [0.746]	-0.002 [0.967]	0.033 [0.485]	0.172** [0.013]	-0.029 [0.413]
AUDIT	-0.008 [0.770]	0.019 [0.420]	0.012 [0.651]	0.010 [0.675]	-0.061 [0.154]	0.017 [0.389]
Log(Bank)	-0.038 [0.237]	-0.017 [0.410]	0.005 [0.867]	-0.031 [0.154]	-0.081** [0.014]	-0.001 [0.950]
Rel. Length	-0.008 [0.662]	-0.002 [0.908]	-0.004 [0.864]	-0.009 [0.561]	0.016 [0.442]	-0.013 [0.409]
Firm Age	0.050*** [0.004]	0.036** [0.021]	0.040 [0.155]	0.041 [0.134]	0.028 [0.171]	0.042*** [0.003]
PROFIT	-0.005 [0.580]	0.008 [0.182]	0.010 [0.145]	0.001 [0.848]	0.008 [0.154]	0.000 [0.989]

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FA/TA	0.057 [0.295]	-0.041 [0.466]	0.082 [0.171]	-0.014 [0.781]	0.061 [0.361]	0.028 [0.568]
Firm Size	-0.031 [0.164]	-0.004 [0.789]	-0.020 [0.103]	0.002 [0.829]	0.001 [0.958]	-0.007 [0.575]
LEVERAGE	19.695 [0.670]	-0.013*** [0.000]	-39.175 [0.353]	-0.011*** [0.000]	-22.161 [0.644]	-0.010*** [0.000]
CORPORATION	0.028 [0.545]	0.071 [0.304]	-0.036 [0.584]	0.132*** [0.000]	0.101* [0.090]	0.050 [0.339]
GROUPE	-0.008 [0.833]	-0.039* [0.090]	-0.024 [0.467]	-0.028 [0.246]	-0.038 [0.236]	-0.016 [0.491]
CONSORTIUM	-0.014 [0.779]	-0.015 [0.814]	-0.039 [0.526]	0.060 [0.258]	-0.054 [0.545]	-0.009 [0.849]
NATIONAL BANK	0.037 [0.134]	0.023 [0.339]	-0.004 [0.885]	0.030 [0.153]	- -	- -
GDP	0.570 [0.738]	6.062 [0.109]	0.203 [0.899]	1.013** [0.049]	0.616 [0.281]	0.859 [0.594]
HHI1	-0.715 [0.697]	4.988*** [0.000]	-3.108** [0.026]	24.782*** [0.003]	16.523* [0.085]	2.310 [0.147]
Loans/Deposit	-0.248 [0.432]	-0.060 [0.849]	-0.242 [0.398]	0.778*** [0.000]	0.495** [0.028]	-0.087 [0.770]
Civil Suits	49.050 [0.836]	15.376 [0.792]	-27.600 [0.898]	95.126*** [0.000]	88.163*** [0.000]	36.232 [0.870]
Province Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-5.220 [0.764]	-62.909* [0.097]	-1.182 [0.942]	-14.454** [0.021]	-9.047 [0.199]	-9.095 [0.580]
Observations	469	502	426	545	342	629
R ²	0.247	0.252	0.227	0.262	0.332	0.162
Adjusted R ²	0.024	0.051	-0.008	0.076	0.067	-0.020

Table A5

Determinants of the Portion of Trade Credit in Total Assets

These regressions show the impact of the use of soft information and of lending technologies, divided into four indicators, on the quantity of trade credit in total assets. We control for bank-firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	(1)	(2)	(3)	(4)	(5)
	TC/TA	TC/TA	TC/TA	TC/TA	TC/TA
SOFT	-0.057 [0.183]	-0.068 [0.155]	-0.032 [0.455]	-0.041 [0.340]	-0.055 [0.254]
LT_REL	0.001 [0.980]	0.035 [0.474]	-0.011 [0.800]	0.002 [0.971]	0.019 [0.745]
SOFT * LT_REL	-0.190 [0.305]	-0.078 [0.528]	-0.112 [0.429]	0.018 [0.897]	-0.201 [0.280]
LT_TRANS	0.010 [0.870]				
SOFT * LT_TRANS	0.322* [0.095]				
LT_FS		-0.031 [0.445]			-0.047 [0.267]
SOFT * LT_FS		0.171 [0.140]			0.169 [0.150]
LT_RE			0.030 [0.424]		0.042 [0.302]
SOFT * LT_RE			0.199* [0.086]		0.222** [0.048]
LT_OF				0.012 [0.829]	0.004 [0.948]
SOFT * LT_OF				0.046 [0.727]	-0.089 [0.502]
Credit Rationed	0.010 [0.796]	0.005 [0.903]	0.012 [0.741]	0.010 [0.794]	0.008 [0.837]
AUDIT	0.007 [0.723]	0.010 [0.629]	0.007 [0.742]	0.008 [0.704]	0.008 [0.676]
Log(bank)	-0.027 [0.184]	-0.026 [0.199]	-0.029 [0.152]	-0.026 [0.201]	-0.030 [0.141]
Rel. Length	-0.007	-0.010	-0.006	-0.007	-0.008

Chapter 3: Is Trade Credit a Substitute for Relationship Lending Credit?

Firm Age	[0.638] 0.044***	[0.520] 0.045***	[0.700] 0.044***	[0.617] 0.044***	[0.602] 0.044***
PROFIT	[0.001] 0.007	[0.001] 0.007	[0.002] 0.006	[0.002] 0.007	[0.001] 0.006
FA/TA	[0.202] -0.028	[0.193] -0.027	[0.238] -0.033	[0.192] -0.027	[0.251] -0.036
Firm Size	[0.515] -0.012	[0.539] -0.013	[0.446] -0.011	[0.539] -0.013	[0.417] -0.010
LEVERAGE	[0.219] -0.013***	[0.196] -0.013***	[0.269] -0.013***	[0.191] -0.013***	[0.291] -0.012***
CORPORATION	[0.000] 0.057	[0.000] 0.053	[0.000] 0.060	[0.000] 0.052	[0.000] 0.064
GROUPE	[0.220] -0.015	[0.247] -0.014	[0.196] -0.016	[0.259] -0.015	[0.173] -0.015
CONSORTIUM	[0.516] -0.033	[0.546] -0.030	[0.478] -0.038	[0.526] -0.029	[0.510] -0.039
NATIONAL BANK	[0.478] 0.023	[0.524] 0.022	[0.398] 0.024	[0.536] 0.022	[0.374] 0.025
GDP	[0.232] 1.013*	[0.250] 0.993*	[0.209] 1.034*	[0.258] 1.002*	[0.194] 1.039*
HHI1	[0.062] 23.953***	[0.069] 23.967***	[0.058] 24.382***	[0.064] 23.547***	[0.061] 25.116***
Loans/Deposit	[0.002] 0.827***	[0.001] 0.835***	[0.001] 0.842***	[0.002] 0.818***	[0.001] 0.869***
Civil Suits	[0.000] 67.732***	[0.000] 68.419***	[0.000] 68.811***	[0.000] 69.933***	[0.000] 67.650***
Province Indicators	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes
Sector Indicators	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes
Constant	-14.578** [0.020]	-14.373** [0.022]	-14.859** [0.018]	-14.408** [0.021]	-15.020** [0.018]
Observations	971	971	971	971	971
R ²	0.132	0.130	0.134	0.128	0.137
Adjusted R ²	0.008	0.005	0.009	0.003	0.008

Table A6

Determinants of the P of Trade Credit in Total Assets in Subsamples

These regressions show the impact of the use of soft information and of lending technologies on the quantity of trade in total asset in subsamples based on the number of employees (Columns 1 and 2), age (Columns 3 and 4) and bank type (Columns 5 and 6). We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	By number of employees		By firm age		By bank type	
	≤ mean	> mean	≤ mean	> mean	National	Local
	(1)	(2)	(3)	(4)	(5)	(6)
	TC/TA	TC/TA	TC/TA	TC/TA	TC/TA	TC/TA
SOFT	0.005 [0.948]	-0.102* [0.080]	0.117 [0.256]	-0.145*** [0.002]	-0.048 [0.445]	-0.072 [0.260]
LT_REL	-0.001 [0.990]	0.010 [0.900]	-0.075 [0.333]	0.044 [0.599]	-0.051 [0.585]	-0.037 [0.663]
SOFT * LT_REL	0.330 [0.196]	-0.380*** [0.008]	0.249 [0.370]	-0.410*** [0.002]	-0.099 [0.732]	-0.153 [0.421]
LT_TRANS	0.110 [0.253]	-0.085 [0.308]	0.151* [0.095]	-0.058 [0.484]	0.064 [0.551]	-0.017 [0.839]
SOFT * LT_TRANS	-0.316 [0.266]	0.643*** [0.000]	-0.407 [0.186]	0.771*** [0.000]	0.214 [0.467]	0.400* [0.070]
Credit Rationed	0.051 [0.319]	-0.008 [0.904]	-0.001 [0.987]	0.041 [0.486]	0.206** [0.018]	-0.019 [0.663]
AUDIT	-0.003 [0.921]	0.033 [0.274]	0.000 [0.999]	0.037 [0.232]	-0.077 [0.129]	0.024 [0.315]
Log(Bank)	-0.038 [0.330]	-0.018 [0.461]	0.005 [0.891]	-0.029 [0.276]	-0.089** [0.024]	0.005 [0.850]
Rel. Length	-0.016 [0.489]	-0.003 [0.887]	-0.005 [0.868]	-0.017 [0.390]	0.002 [0.928]	-0.013 [0.516]
Firm Age	0.068*** [0.002]	0.040** [0.043]	0.054 [0.128]	0.046 [0.204]	0.036 [0.175]	0.052*** [0.003]
PROFIT	-0.003 [0.776]	0.013** [0.042]	0.013 [0.116]	0.008 [0.249]	0.014** [0.036]	0.005 [0.572]

Chapter 3: Is Trade Credit a Substitute for Relationship Lending Credit?

FA/TA	-0.031 [0.632]	-0.077 [0.269]	0.016 [0.827]	-0.089 [0.138]	-0.031 [0.720]	-0.036 [0.526]
Firm Size	-0.047* [0.081]	-0.012 [0.485]	-0.029* [0.060]	-0.008 [0.523]	-0.005 [0.743]	-0.020 [0.169]
LEVERAGE	130.519** [0.030]	-0.014*** [0.000]	18.195 [0.721]	-0.012*** [0.000]	90.433 [0.171]	-0.012*** [0.000]
CORPORATION	0.044 [0.450]	0.080 [0.388]	-0.044 [0.609]	0.153*** [0.001]	0.113 [0.160]	0.060 [0.341]
GROUPE	0.011 [0.817]	-0.039 [0.177]	-0.001 [0.977]	-0.029 [0.352]	-0.047 [0.250]	-0.007 [0.814]
CONSORTIUM	-0.036 [0.552]	0.001 [0.994]	-0.035 [0.649]	0.049 [0.441]	-0.098 [0.351]	-0.017 [0.773]
NATIONAL BANK	0.045 [0.139]	0.040 [0.183]	0.001 [0.979]	0.036 [0.192]	-	-
GDP	0.336 [0.868]	9.914* [0.085]	-0.037 [0.985]	1.259* [0.086]	0.418 [0.508]	1.936 [0.394]
HHI1	-1.563 [0.455]	6.300** [0.013]	-3.833** [0.027]	36.790*** [0.002]	20.908** [0.049]	0.773 [0.707]
Loans/Deposit	-0.247 [0.519]	-0.186 [0.691]	-0.255 [0.471]	1.155*** [0.000]	0.632** [0.014]	-0.276 [0.510]
Civil Suits	24.741 [0.929]	-59.126 [0.500]	-77.511 [0.770]	84.163*** [0.000]	68.232*** [0.000]	177.270 [0.563]
Province Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-2.735 [0.895]	-102.097* [0.077]	1.496 [0.941]	-18.823** [0.036]	-7.731 [0.320]	-19.869 [0.390]
Observations	469	502	426	545	342	629
R ²	0.246	0.222	0.219	0.232	0.312	0.157
Adjusted R ²	0.023	0.013	-0.018	0.039	0.039	-0.026

Table A7

Determinants of the part of Trade Credit in Total Short-Term Loan

These regressions show the impact of the use of soft information and of lending technologies, divided into four indicators, on the quantity of trade credit in total short-term loan. We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	(1)	(2)	(3)	(4)	(5)
	TC/STL	TC/STL	TC/STL	TC/STL	TC/STL
SOFT	-0.099 [0.172]	-0.122 [0.130]	-0.048 [0.506]	-0.065 [0.369]	-0.114 [0.154]
LT_REL	0.032 [0.761]	0.118 [0.204]	0.015 [0.853]	0.029 [0.768]	0.070 [0.512]
SOFT * LT_REL	-0.461 [0.144]	-0.219 [0.327]	-0.189 [0.424]	-0.118 [0.627]	-0.513 [0.109]
LT_TRANS	0.044 [0.700]				
SOFT * LT_TRANS	0.691** [0.034]				
LT_FS		-0.063 [0.385]			-0.104 [0.163]
SOFT * LT_FS		0.370* [0.073]			0.407** [0.046]
LT_RE			0.076 [0.286]		0.098 [0.208]
SOFT * LT_RE			0.294 [0.129]		0.185 [0.383]
LT_OF				0.056 [0.614]	0.033 [0.779]
SOFT * LT_OF				0.244 [0.301]	0.126 [0.621]
Credit Rationed	-0.014 [0.823]	-0.027 [0.681]	-0.011 [0.864]	-0.012 [0.852]	-0.020 [0.762]
AUDIT	0.017 [0.651]	0.024 [0.529]	0.017 [0.655]	0.017 [0.645]	0.019 [0.610]
Log(bank)	-0.056 [0.134]	-0.054 [0.149]	-0.059 [0.115]	-0.053 [0.152]	-0.058 [0.117]
Rel. Length	-0.017	-0.024	-0.016	-0.018	-0.020

Chapter 3: Is Trade Credit a Substitute for Relationship Lending Credit?

Firm Age	[0.523] 0.074***	[0.392] 0.075***	[0.561] 0.073***	[0.513] 0.073***	[0.462] 0.075***
PROFIT	[0.006] 0.005	[0.005] 0.006	[0.007] 0.005	[0.007] 0.006	[0.005] 0.005
FA/TA	[0.595] 0.276***	[0.571] 0.279***	[0.660] 0.268***	[0.566] 0.279***	[0.633] 0.267***
Firm Size	[0.002] -0.014	[0.001] -0.015	[0.002] -0.012	[0.001] -0.016	[0.002] -0.013
LEVERAGE	[0.422] -0.020***	[0.372] -0.018***	[0.489] -0.019***	[0.352] -0.020***	[0.471] -0.019***
CORPORATION	[0.000] 0.079	[0.000] 0.071	[0.000] 0.081	[0.000] 0.070	[0.000] 0.085
GROUPE	[0.369] 0.001	[0.415] 0.003	[0.358] -0.001	[0.418] 0.003	[0.335] 0.005
CONSORTIUM	[0.980] -0.050	[0.942] -0.044	[0.980] -0.057	[0.945] -0.040	[0.912] -0.050
NATIONAL BANK	[0.532] 0.030	[0.586] 0.028	[0.475] 0.031	[0.628] 0.028	[0.533] 0.032
GDP	[0.399] 1.949**	[0.424] 1.901**	[0.379] 1.972**	[0.433] 1.941**	[0.362] 1.978**
HHI1	[0.023] 30.008**	[0.029] 30.055**	[0.022] 30.603***	[0.023] 29.154**	[0.024] 31.661***
Loans/Deposit	[0.012] 0.928***	[0.011] 0.949***	[0.010] 0.953***	[0.014] 0.905***	[0.007] 0.988***
Civil Suits	[0.001] 185.965***	[0.001] 187.688***	[0.001] 189.176***	[0.001] 191.103***	[0.001] 187.107***
Province Indicators	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes
Sector Indicators	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes
Constant	-25.562** [0.010]	-25.089** [0.012]	-25.895*** [0.009]	-25.354** [0.010]	-26.118*** [0.009]
Observations	965	965	965	965	965
R ²	0.149	0.146	0.148	0.145	0.153
Adjusted R ²	0.026	0.023	0.025	0.022	0.025

Table A8

Determinants of the Portion of Trade Credit in Total Short-Term Loan in Subsamples

These regressions show the impact of the use of soft information and of lending technologies on the quantity of trade in total short-term loan in subsamples based on the number of employees (Columns 1 and 2), age (Columns 3 and 4) and bank type (Columns 5 and 6). We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	By number of employees		By firm age		By bank type	
	≤ mean	> mean	≤ mean	> mean	National	Local
	(1) TC/STL	(2) TC/STL	(3) TC/STL	(4) TC/STL	(5) TC/STL	(6) TC/STL
SOFT	0.040 [0.746]	-0.192* [0.054]	0.162 [0.305]	-0.229** [0.011]	-0.094 [0.387]	-0.146 [0.177]
LT_REL	0.119 [0.498]	-0.027 [0.856]	-0.048 [0.739]	0.019 [0.904]	-0.182 [0.314]	0.089 [0.578]
SOFT * LT_REL	0.252 [0.561]	-0.700** [0.012]	0.370 [0.404]	-0.771*** [0.003]	-0.214 [0.663]	-0.350 [0.341]
LT_TRANS	0.127 [0.450]	-0.037 [0.832]	0.234 [0.153]	-0.001 [0.996]	0.298 [0.163]	-0.120 [0.403]
SOFT * LT_TRANS	-0.297 [0.546]	1.161*** [0.000]	-0.521 [0.291]	1.300*** [0.000]	0.383 [0.458]	0.799** [0.039]
Credit Rationed	0.048 [0.576]	-0.019 [0.875]	0.007 [0.944]	0.041 [0.690]	0.279* [0.086]	-0.052 [0.501]
AUDIT	-0.009 [0.880]	0.055 [0.323]	0.032 [0.581]	0.014 [0.799]	-0.100 [0.304]	0.053 [0.221]
Log(Bank)	-0.058 [0.432]	-0.045 [0.332]	0.018 [0.777]	-0.062 [0.203]	-0.138* [0.074]	-0.011 [0.812]
Rel. Length	-0.035 [0.429]	-0.006 [0.875]	-0.012 [0.817]	-0.031 [0.388]	0.046 [0.338]	-0.037 [0.324]
Firm Age	0.085* [0.063]	0.083** [0.019]	0.066 [0.300]	0.100 [0.126]	0.045 [0.322]	0.086** [0.017]
PROFIT	-0.015 [0.495]	0.017 [0.188]	0.019 [0.216]	0.004 [0.769]	0.018 [0.141]	0.002 [0.914]

Chapter 3: Is Trade Credit a Substitute for Relationship Lending Credit?

FA/TA	0.382*** [0.004]	0.038 [0.773]	0.387*** [0.006]	0.154 [0.193]	0.345** [0.036]	0.238** [0.035]
Firm Size	-0.057 [0.245]	-0.022 [0.450]	-0.052* [0.053]	0.000 [0.990]	-0.001 [0.983]	-0.022 [0.407]
LEVERAGE	48.303 [0.639]	-0.024*** [0.000]	-103.273 [0.248]	-0.022*** [0.000]	-107.857 [0.301]	-0.015*** [0.001]
CORPORATION	0.014 [0.888]	0.104 [0.553]	-0.115 [0.481]	0.263*** [0.003]	0.190 [0.220]	0.097 [0.384]
GROUPE	0.035 [0.703]	-0.033 [0.522]	0.002 [0.979]	-0.010 [0.858]	-0.049 [0.508]	0.017 [0.761]
CONSORTIUM	-0.031 [0.770]	-0.080 [0.580]	-0.073 [0.551]	0.068 [0.550]	-0.169 [0.400]	-0.022 [0.829]
NATIONAL BANK	0.066 [0.234]	0.055 [0.323]	-0.004 [0.939]	0.059 [0.232]	- -	- -
GDP	2.622 [0.507]	10.090 [0.191]	0.345 [0.919]	2.351** [0.048]	1.530 [0.271]	2.073 [0.543]
HHI1	1.941 [0.627]	10.228*** [0.000]	-5.400* [0.067]	49.422*** [0.008]	33.758 [0.133]	4.694 [0.155]
Loans/Deposit	-0.497 [0.492]	-0.037 [0.954]	-0.415 [0.500]	1.448*** [0.000]	0.996* [0.054]	-0.202 [0.749]
Civil Suits	322.600 [0.551]	88.361 [0.461]	-35.239 [0.938]	204.347*** [0.000]	206.585*** [0.000]	141.516 [0.761]
Province Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-26.344 [0.513]	-105.374 [0.174]	-2.073 [0.953]	-31.998** [0.026]	-21.251 [0.209]	-22.138 [0.524]
Observations	468	497	423	542	341	624
R ²	0.262	0.223	0.240	0.255	0.334	0.163
Adjusted R ²	0.043	0.012	0.007	0.067	0.069	-0.020

Table A9

Determinants of the DPO

These regressions show the impact of the use of soft information and of lending technologies, divided into four indicators, on duration of trade measured by the DPO. We control for bank-firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	(1)	(2)	(3)	(4)	(5)
	DPO	DPO	DPO	DPO	DPO
SOFT	-7.701 [0.640]	-6.684 [0.716]	4.245 [0.785]	-0.673 [0.966]	-3.528 [0.845]
LT_REL	4.140 [0.825]	13.441 [0.442]	-4.884 [0.747]	9.189 [0.606]	14.220 [0.461]
SOFT * LT_REL	-66.214 [0.319]	15.423 [0.735]	-21.981 [0.698]	-3.673 [0.944]	-69.837 [0.290]
LT_TRANS	-3.397 [0.863]				
SOFT * LT_TRANS	158.052** [0.026]				
LT_FS		-12.746 [0.339]			-16.653 [0.241]
SOFT * LT_FS		47.783 [0.239]			48.092 [0.244]
LT_RE			10.313 [0.433]		19.238 [0.192]
SOFT * LT_RE			90.810* [0.074]		71.414 [0.274]
LT_OF				-10.739 [0.554]	-16.384 [0.411]
SOFT * LT_OF				79.817 [0.110]	35.688 [0.572]
Credit Rationed	6.830 [0.594]	5.402 [0.677]	8.291 [0.514]	6.861 [0.594]	6.317 [0.623]
AUDIT	1.855 [0.811]	2.674 [0.731]	1.428 [0.853]	2.280 [0.769]	2.527 [0.744]
Log(bank)	-13.381* [0.068]	-13.086* [0.078]	-14.275** [0.050]	-12.786* [0.083]	-14.195** [0.050]
Rel. Length	2.248	1.377	2.930	2.157	2.158

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Firm Age	[0.699] 11.917**	[0.814] 11.928**	[0.615] 11.531**	[0.712] 11.906**	[0.712] 12.004**
PROFIT	[0.018] 0.581	[0.018] 0.636	[0.022] 0.387	[0.018] 0.595	[0.017] 0.321
FA/TA	[0.817] 64.337**	[0.801] 64.779**	[0.877] 62.247**	[0.811] 65.386**	[0.899] 62.223**
Firm Size	[0.013] 0.890	[0.013] 0.583	[0.016] 1.355	[0.012] 0.568	[0.016] 1.438
LEVERAGE	[0.848] -3.552***	[0.901] -3.369***	[0.771] -3.489***	[0.903] -3.315***	[0.756] -3.032***
CORPORATION	[0.000] 28.236*	[0.000] 26.289	[0.000] 29.824*	[0.000] 25.290	[0.000] 29.469*
GROUPE	[0.078] -13.558*	[0.113] -13.248	[0.059] -14.219*	[0.125] -13.347	[0.063] -13.510*
CONSORTIUM	[0.097] -5.675	[0.105] -4.208	[0.081] -8.004	[0.103] -3.479	[0.097] -7.111
NATIONAL BANK	[0.740] 12.818*	[0.811] 12.373*	[0.628] 13.188*	[0.845] 12.534*	[0.671] 13.690*
GDP	[0.074] 358.261**	[0.087] 350.021**	[0.067] 367.944**	[0.082] 349.389**	[0.059] 362.462**
HHI1	[0.013] 5786.920***	[0.016] 5729.059***	[0.010] 5942.525***	[0.015] 5568.484***	[0.014] 6125.585***
Loans/Deposit	[0.005] 191.789***	[0.005] 193.396***	[0.004] 196.498***	[0.007] 186.827***	[0.003] 204.680***
Civil Suits	[0.000] 3.3e+04***	[0.000] 3.3e+04***	[0.000] 3.3e+04***	[0.000] 3.4e+04***	[0.000] 3.3e+04***
Province Indicators	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes
Sector Indicators	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes	[0.000] Yes
Constant	-4.8e+03*** [0.005]	-4.7e+03*** [0.006]	-4.9e+03*** [0.004]	-4.6e+03*** [0.006]	-4.8e+03*** [0.005]
Observations	968	968	968	968	968
R ²	0.169	0.164	0.170	0.165	0.172
Adjusted R ²	0.049	0.043	0.050	0.045	0.048

Table A10

Determinants of DPO in Subsamples

These regressions show the impact of the use of soft information and of lending technologies on the duration of trade measured by the DPO in subsamples, based on the number of employees (Columns 1 and 2), age (Columns 3 and 4) and bank type (Columns 5 and 6). We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	By number of employees		By firm age		By bank type	
	≤ mean	> mean	≤ mean	> mean	National	Local
	(1)	(2)	(3)	(4)	(5)	(6)
	DPO	DPO	DPO	DPO	DPO	DPO
SOFT	-3.838 [0.891]	-17.120 [0.449]	56.991 [0.173]	-46.362*** [0.005]	-7.821 [0.725]	-8.510 [0.725]
LT_REL	10.816 [0.722]	11.777 [0.672]	-27.585 [0.299]	10.548 [0.700]	-14.209 [0.645]	-9.786 [0.722]
SOFT * LT_REL	95.709 [0.257]	-149.724*** [0.007]	124.257 [0.175]	-154.948*** [0.002]	-64.245 [0.552]	9.925 [0.726]
LT_TRANS	33.655 [0.261]	-48.188 [0.112]	73.404** [0.017]	-30.241 [0.252]	16.142 [0.651]	112.790 [0.309]
SOFT * LT_TRANS	-2.712 [0.979]	273.849*** [0.000]	-169.051 [0.125]	372.113*** [0.000]	132.425 [0.243]	7.455 [0.946]
Credit Rationed	18.989 [0.262]	1.574 [0.947]	7.891 [0.676]	6.467 [0.740]	31.954 [0.369]	-2.802 [0.850]
AUDIT	5.244 [0.633]	5.458 [0.658]	-2.247 [0.844]	16.214 [0.165]	-1.071 [0.960]	3.750 [0.667]
Log(Bank)	-6.792 [0.629]	-19.661* [0.052]	-4.978 [0.722]	-14.270 [0.127]	-25.913* [0.069]	-5.286 [0.559]
Rel. Length	-7.819 [0.328]	11.144 [0.183]	-1.043 [0.938]	2.193 [0.743]	3.346 [0.715]	1.918 [0.816]
Firm Age	17.084** [0.029]	11.192 [0.137]	18.069 [0.165]	18.454 [0.115]	17.373* [0.061]	8.614 [0.190]
PROFIT	-0.129 [0.974]	0.852 [0.810]	-1.369 [0.797]	4.835** [0.036]	4.276* [0.068]	-1.527 [0.742]
FA/TA	42.163* [0.084]	70.207 [0.123]	104.919** [0.033]	31.206 [0.228]	46.186 [0.202]	61.798* [0.067]

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Firm Size	-12.387 [0.174]	2.356 [0.766]	1.641 [0.868]	-2.874 [0.520]	-4.160 [0.428]	3.619 [0.642]
LEVERAGE	3.6e+04* [0.084]	-3.665*** [0.001]	2.5e+04 [0.375]	-3.130*** [0.000]	7.4e+04* [0.051]	-3.358*** [0.000]
CORPORATION	12.259 [0.523]	50.696* [0.096]	10.545 [0.724]	57.049*** [0.002]	15.372 [0.601]	45.890** [0.011]
GROUPE	-12.420 [0.399]	-20.706* [0.063]	-17.644 [0.275]	-10.785 [0.295]	-15.473 [0.265]	-12.442 [0.241]
CONSORTIUM	4.234 [0.854]	-1.687 [0.960]	-0.664 [0.982]	12.928 [0.526]	-11.321 [0.824]	-2.427 [0.907]
NATIONAL BANK	27.073** [0.010]	11.596 [0.362]	-2.456 [0.838]	28.269*** [0.003]	-	-
GDP	48.059 [0.943]	1571.269 [0.266]	-23.574 [0.971]	408.460* [0.051]	153.181 [0.461]	257.226 [0.664]
HHI	13.717 [0.985]	2268.928*** [0.000]	-1.1e+03* [0.080]	9052.273*** [0.008]	3859.310 [0.269]	649.865 [0.302]
Civil suits	-77.438 [0.533]	38.928 [0.747]	-84.478 [0.473]	287.104*** [0.000]	110.864 [0.222]	-41.708 [0.708]
Province Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-275.475 [0.968]	-1.7e+04 [0.243]	524.548 [0.937]	-5.8e+03** [0.024]	-2.3e+03 [0.374]	-2.7e+03 [0.656]
Observations	467	501	424	544	341	627
R ²	0.283	0.236	0.290	0.266	0.348	0.198
Adjusted R ²	0.070	0.030	0.073	0.082	0.087	0.023

Table A11

Determinants of Trade Credit – Main lending technology analysis

These regressions show the impact of the use of soft information and the main lending technologies used on the portion of Trade Credit. We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	(1)	(2)	(3)	(4)
	TC/TL	TC/TA	TC/STL	DPO
SOFT	-0.065 [0.149]	-0.055 [0.372]	-0.144 [0.140]	-6.709 [0.768]
MAINREL	-0.033 [0.372]	-0.040 [0.386]	-0.045 [0.594]	-13.672 [0.403]
SOFT * MAINREL	-0.258*** [0.000]	-0.269*** [0.000]	-0.622*** [0.000]	-119.040*** [0.000]
MAINTRANS	-0.000 [0.988]	-0.006 [0.770]	0.008 [0.829]	-2.838 [0.688]
SOFT * MAINTRANS	0.102* [0.059]	0.081 [0.268]	0.218* [0.067]	47.502* [0.097]
Control Variables	All	All	All	All
Province Indicators	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes
Constant	-11.825*** [0.008]	-13.845** [0.024]	-25.178** [0.011]	-4.7e+03*** [0.004]
Observations	971	971	965	968
R ²	0.148	0.134	0.141	0.155
Adjusted R ²	0.033	0.017	0.025	0.041

Table A12

Determinants of the Portion of Trade Credit in Total Loan, Total Assets and Total Short-Term Loan in Subsamples Based on Number Of Banks

These regressions show the impact of the use of soft information and of lending technologies on the quantity of trade credit on subsamples based on the number of banks the firm deals with. We control for bank–firm relationship and firm characteristic variables. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

	By number of banks							
	≤ 3 banks				> 3 banks			
	(1) TC/TL	(2) TC/TA	(3) TC/DST	(4) DPO	(5) TC/TL	(6) TC/TA	(7) TC/DST	(8) DPO
SOFT	-0.079 [0.235]	-0.122* [0.094]	-0.177 [0.218]	-28.994 [0.276]	-0.046 [0.268]	-0.050 [0.371]	-0.087 [0.360]	-5.427 [0.792]
LT_REL	0.069 [0.426]	0.083 [0.421]	0.114 [0.564]	16.185 [0.631]	0.019 [0.752]	-0.004 [0.959]	0.044 [0.749]	6.602 [0.791]
SOFT * LT_REL	-0.319 [0.165]	-0.309 [0.212]	-0.615 [0.196]	-76.674 [0.465]	-0.178 [0.347]	-0.102 [0.705]	-0.268 [0.542]	-73.771 [0.420]
LT_TRANS	-0.084 [0.276]	-0.088 [0.326]	-0.162 [0.340]	-14.531 [0.627]	0.006 [0.929]	0.027 [0.739]	0.079 [0.619]	-9.160 [0.745]
SOFT * LT_TRANS	0.542** [0.026]	0.581** [0.035]	1.288** [0.011]	246.077** [0.030]	0.310 [0.113]	0.215 [0.433]	0.410 [0.362]	145.721 [0.139]
Control Variables	All	All	All	All	All	All	All	All
Province Indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	2.279 [0.918]	5.872 [0.836]	16.993 [0.727]	3537.504 [0.683]	-11.360** [0.032]	-14.084* [0.059]	-25.325** [0.036]	-3.2e+03 [0.135]
Observations	354	354	351	353	617	617	614	615
R ²	0.331	0.347	0.320	0.420	0.202	0.190	0.203	0.204
Adjusted R ²	0.082	0.103	0.063	0.202	0.025	0.011	0.025	0.027

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Table A13 - IV estimations

The table reports results for our instrumental variable regression. First part reports the first stage of our IV regression where our endogenous variables are LT_TRANS, LT_REL and SOFT. Second part reports the second stage of our IV regression. Variables with an * are our estimated endogenous variables. *Control* corresponds to all the exogenous variables used in normal regression. The regression is robust to heteroscedasticity. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$ (as indicated in brackets).

First stage IV regress				
	(1)	(2)	(3)	
	LT_TRANS	LT_REL	SOFT	
<i>Instrumental variables</i>				
Provincial LT_TRANS	2.329 [0.197]	2.860 [0.225]		
L.O. Turnover	0.036*** [0.010]	-0.034** [0.011]		
Banks' M&A	-0.581** [0.036]	0.307 [0.407]		
Functional distance	-0.105 [0.394]	-0.001 [0.992]		
Length of Relationship			0.001* [0.077]	
Self-Confident			0.254*** [0.000]	
Control	All	All	All	
Observations	837	837	837	
R ²	0.659	0.668	0.219	
Adjusted R ²	0.606	0.616	0.098	
F instruments	64.22	63.05	16.02	
Second stage IV regress				
	(1)	(2)	(3)	(4)
	TC/TL	TC/TA	TC/STL	DPO
SOFT*	-0.104 [0.552]	-0.048 [0.833]	-0.351 [0.380]	-4.919 [0.946]
LT_REL*	0.131 [0.193]	0.124 [0.316]	0.460* [0.051]	44.871 [0.269]
SOFT* # LT_REL*	-0.976* [0.058]	-1.187* [0.079]	-2.768** [0.030]	-394.820* [0.066]
LT_TRANS*	0.014 [0.889]	0.001 [0.992]	-0.014 [0.951]	-18.537 [0.646]
SOFT* # LT_TRANS*	0.822* [0.092]	0.982 [0.120]	2.273* [0.059]	412.344* [0.054]
Control	All	All	All	All
Observations	837	837	831	835
R ²	0.164	0.148	0.169	0.185
Adjusted R ²	0.034	0.016	0.039	0.060

Conclusion générale

Le financement relationnel est un mécanisme de financement complexe dont la définition a fortement évolué. Nous savons désormais qu'il repose sur plusieurs éléments récurrents : la durée de la relation entre la firme et la banque, le faible nombre de financeurs de l'entreprise et l'exclusivité de la relation, la forte intensité de la relation, à travers de nombreux contacts et services fournis par la banque, et enfin la technologie de financement relationnelle utilisée par la banque, basée sur l'accumulation et l'utilisation de l'information Soft. Il a également été démontré que son utilisation présente plusieurs avantages : il permet à la firme d'obtenir un financement à un taux favorable dans des périodes financières difficiles en contrepartie d'un taux plus élevé quand tout va bien ; il garantit la confidentialité des données de l'entreprise ; et enfin il est générateur de valeur pour cette dernière. Si nous comprenons désormais mieux ce financement, des questions subsistent. Cette thèse se focalise autour de trois axes qui sont les déterminants, l'utilisation et la substitution du financement relationnel bancaire.

Avant toute analyse de nature empirique, la première étape est de mesurer l'objet d'étude, dans notre cas la technologie de financement relationnelle. Ainsi, dans notre premier article, nous développons un modèle empirique permettant de capturer l'information utilisée lors de l'octroi de crédit. Notre méthodologie se rapproche de celles développées par Fischer (2000) et Cerquiero *et al.* (2011). Notre mesure est basée sur des données de crédits de PME américaines issues de la SSBF 2003. Cela nous permet d'étudier l'impact de la concentration bancaire sur l'utilisation de l'information Soft par la banque. A notre connaissance, nous sommes les premiers à démontrer empiriquement le résultat théorique développé par Dinç (2000). La banque favorise un financement transactionnel lorsque la compétition est faible, relationnel quand celle-ci s'intensifie avec un retour au financement transactionnel en cas de forte compétition. Ces résultats confirment la vision du financement relationnel comme protection, pour la banque, contre la compétition bancaire, cependant cette protection n'est pas absolue.

Notre étude se base sur des données Nord-Américaines, il serait intéressant de comparer ces résultats avec une analyse faite sur une autre zone géographique. L'utilisation de la base de données EFIGE permettrait de reproduire cette analyse au niveau de PME européennes et ainsi d'analyser l'impact de la concentration bancaire de chaque pays, sur la mise en place du financement.

Conclusion générale

Notre deuxième article traite des questions de discrimination au sein du système bancaire. Il est bien établi que le relationnel bancaire permet de réduire le rationnement de crédit et modifie les conditions de celui-ci. Il est également établi que les minorités, tant ethniques que de genre, subissent des discriminations sur le marché du crédit. Ces discriminations se traduisent par un rationnement plus fréquent et des crédits plus chers. Notre question était de savoir si la mise en place d'une technologie relationnelle permet de réduire cette discrimination. Nous montrons que dans un premier temps, l'utilisation d'une technologie de financement relationnelle accentue les problèmes de discrimination. Les multiples contacts, liés à la mise en place du financement relationnel, tendent à exacerber les préjugés du chargé d'affaires. Cependant, lorsque la durée de la relation augmente, la discrimination existante diminue. La connaissance d'un individu diminue les préjugés envers celui-ci. Nous démontrons également que dans des zones à forte concentration en minorités, le relationnel bancaire semble réduire plus fortement la discrimination. Cela peut s'expliquer par le fait qu'une forte concentration en minorité augmente la probabilité que le chargé d'affaires soit lui-même issu d'une minorité. Or la discrimination est beaucoup moins importante entre deux personnes d'une même ethnie.

Nous avons traité le problème de la discrimination ethnique et de genre de façon séparée. Cependant, comme le relèvent Micozzi et Lucarelli (2016), au sein d'une même ethnie, les femmes sont plus discriminées que les hommes. Ainsi, il aurait été intéressant de croiser ces deux indicateurs, afin d'augmenter la précision de nos analyses. Cependant, notre base de données ne contient pas assez d'observations sur des femmes appartenant à une minorité ethnique et ayant un relationnel avec leur banque. La base de données EFIGE, couplée à la base Orbis, permettrait de répondre à cette question. En effet, ces bases contiennent des informations sur plus de 14.000 firmes européennes. Parmi ces informations, nous trouvons des données sur la technologie de financement développée entre l'entreprise et la banque, ainsi que sur le sexe et l'appartenance ethnique du manager.

Notre troisième article traite de la substitution du financement relationnel bancaire. Plus précisément de l'utilisation du crédit fournisseur comme substitut à une technologie de financement relationnel inexistante. Notre principal résultat est que les firmes émettant de l'information Soft dont la banque principale est transactionnelle, ont recours à plus de crédit fournisseur que les autres. Le fournisseur accumulant de l'information privée sur ses clients, joue le même rôle que le financeur relationnel. Nous prouvons également que la perception que les firmes ont de leur banque change leur comportement. Il est établi que le statut de la banque,

Conclusion générale

locale ou nationale, représente la perception ex-ante que la firme a de la gestion de l'information par la banque. Une banque locale (nationale) est perçue comme gérant de l'information Soft (Hard). Ainsi, une firme à la recherche d'un financement relationnel favorisera une banque locale. Cependant, certaines banques locales peuvent s'avérer ex-post comme gérant de l'information Hard. Elles ne proposent ainsi pas de financement relationnel aux firmes qui pensaient en trouver. Nous démontrons que ce sont ces firmes, dont la perception ex-ante de leur banque est en inadéquation avec la perception ex-post, qui accroissent leur part de crédit fournisseur. Enfin, l'utilisation du crédit fournisseur comme substitut au financement relationnel, ne semble effective que lorsque les firmes sont en relation avec un faible nombre de banques. Une entreprise ayant un nombre important de partenaires bancaires favorise ses relations existantes avant de négocier avec ses fournisseurs.

Un axe d'approfondissement de ce travail serait d'étudier plus en détail les choix de substitution crédit fournisseur – financement relationnel des firmes. Le but serait de comprendre parfaitement quel type de firme substitue et dans quelles conditions. Pour cela, il serait intéressant d'affiner l'analyse par une segmentation par la taille et l'âge de la firme. Et de croiser cette segmentation avec d'autres caractéristiques, telles que le nombre de banques. Par ailleurs, il existe en Italie des zones géographiques à forte densité d'entreprises et de banques, travaillant en étroite collaboration : les districts industriels. Il conviendrait d'analyser ces zones afin de voir si cette forte collaboration, impacte le comportement de ces entreprises. Enfin, bien que l'Italie, par sa diversité, soit un cadre d'étude intéressant, une telle étude gagnerait à être faite au niveau européen. Il pourrait être utile de reproduire cette analyse au sein de la base EFIGE, base de données similaire à notre base d'études, mais au niveau européen.

Nature et Gestion de l'Information : Impact sur le Financement Relationnel Bancaire

Résumé

Durant les dernières décennies, le financement relationnel a fortement évolué. Il n'est plus considéré maintenant comme un simple mécanisme de réduction de l'asymétrie d'information. Cependant, de nombreuses questions restent non résolues. Quels sont ses déterminants ? Son utilisation impacte-t-elle de la même façon tous les agents ? Quels sont les substituts possibles ? La thèse s'organise autour de ces axes. Le premier chapitre traite de l'impact de la compétition bancaire sur la mise en place du financement relationnel. Le second chapitre s'intéresse à l'utilisation de ce financement par les minorités. Enfin, le troisième chapitre analyse la substitution potentielle entre crédit fournisseur et financement relationnel. En utilisant deux bases de données, l'une sur des PME américaines, l'autre des italiennes, nous montrons empiriquement que : 1. La concurrence interbancaire influence de manière non-linéaire le financement relationnel. Les banques favorisent un financement relationnel quand la compétition est faible, transactionnel quand elle s'intensifie avec un retour au relationnel en cas de forte compétition. Ce résultat est cohérent avec la vision du relationnel bancaire comme mécanisme de protection contre la compétition, tant qu'elle n'est pas trop intense. 2. Si l'utilisation du financement relationnel augmente dans un premier temps la discrimination subie par les minorités ethniques, celle-ci diminue avec le temps. Cela démontre la validité de la théorie psychologique du contact en finance. 3. Les entreprises opaques n'ayant pas accès au financement relationnel utilisent plus de crédit fournisseur. Celui-ci peut être vu comme un financement relationnel.

Mots clefs français : financement relationnel bancaire, compétition, discrimination, crédit fournisseur.

Nature and Management of Information: Impact on Relationship Banking Technology

Abstract

Over the past decades, the definition of relationship banking has greatly evolved. It is no longer considered as a simple mechanism used to reduce information asymmetry. However, many questions remain. What are its determinants? Does its use impact all agents in the same way? What are its potential substitutes? This thesis is organized around these themes. The first chapter examines the impact of banking competition on relationship lending technology. The second chapter studies the use of relationship lending technology by minorities. Finally, the third chapter analyzes the potential substitution between relationship lending technology and trade credit. Using two different databases - the first one composed of US SMEs, the second of Italian SMEs - we empirically show that: 1. Banking competition impacts non-linearly the use of relationship lending technology. Banks favor relationship lending when competition is weak, transactional lending when it increases then return to relationship lending in case of strong competition. 2. If the use of relationship lending technology tends to first increase discrimination against minorities, this discrimination decreases with time. This result could be analyzed as an empirical validation of the psychological theory of contacts in finance. 3. Opaque firms without an access to relationship lending technology use more trade credit. Trade credit can be seen as a relationship lending technology.

Keywords: relationship lending technology, competition, discrimination, trade credit.

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