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**Article**

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## ABSTRACT

*This paper explores empirically the effect of consolidation in the French banking industry and of Basel II on the availability of credit for small and medium-sized enterprises (SMEs). Consolidation has been associated with an increase in the number of banks the average firm borrows from and this has improved credit availability. Furthermore, the paper shows, for France, that the current Basel II proposal would result in lower capital charges on SME loans due to portfolio diversification effects and low default correlations of SMEs. It also argues that the current Basel II proposal is conservative: capital charges could be even lower if they were based on our estimates of SME loan portfolio risk. Overall, in France, credit rationing of SMEs does not seem to be a serious problem and Basel II is unlikely to hold back SME lending.*

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# Financing small businesses in France

## 1. Introduction

Small and medium-sized enterprises (SMEs) are of considerable importance for the French economy. To illustrate, in 1999, they accounted for around half of the turnover and the value added generated by the 2 million French non-financial firms (Ministère de l'Economie et des Finances 2002). In the same year, they carried out 41 percent of total investment and, with more than 10 million employees, accounted for about two-thirds of total employment in France.

Notwithstanding their weight in the economy, SMEs regularly complain about severe financial constraints. In a recent report, the *Conseil National du Crédit et du Titre* (CNCT 1999) recognised that the capital structure of French firms was favourable in the sense that firms were sufficiently capitalised, but observed that some firms actually encountered difficulties in obtaining additional finance to grow. In fact, the recession of the early 1990s compelled non-financial firms to devote considerable efforts to reduce their indebtedness and to strengthen their capital structure. The report emphasised that this change in leverage characterised both large firms and most SMEs. However, according to the CNCT report, financing difficulties remained for small businesses due to difficulties in accessing external funds or obstacles that make managers reluctant to borrow. The CNCT found that these problems did not affect large SMEs and well-established firms, but mainly new firms, very small firms, more traditional SMEs, and firms whose activities were considered "risky".

Until the end of 1996, the move towards greater consolidation of the French banking system, which started in the early 1990s, mainly involved mergers between banks that were affiliated to a banking group. Acquisitions between groups were rare and merely involved takeovers of single banks. All in all, even though the number of credit institutions fell sharply, the number of competing banking groups remained unchanged, and the groups retained their respective market shares. After 1996, all this changed with the first mergers between major banking groups. Crédit Agricole's takeover of Indosuez in 1996 marked the first significant change in the competitive balance of the French banking system. The system then went through a period of sweeping changes with the mergers of Crédit du Nord and Société Générale and Crédit Industriel et Commercial (CIC) and Crédit Mutuel in 1997, followed by the merger of Paribas and BNP in 1999. This consolidation phenomenon is not restricted to France; it is part of a worldwide trend (BIS 2001b).

The main goal of this paper is to explore empirically the influence of the consolidation in the French banking industry on the business loan market in general and on the credit availability for SMEs in particular. Bank credit still remains the major source of external financing for SMEs. Indeed, one of the major functions of banks is to fund complex, illiquid positions, which implies long-term lending to borrowers that constitute "difficult" credits. In carrying out this function, banks have to solve problems resulting from asymmetric information between borrowers and lenders. These information asymmetries



**Michel Dietsch**

*Information asymmetries explain why especially SMEs may encounter problems to access external finance.*

are especially pertinent to small and medium-sized businesses, mainly due to two salient characteristics of SMEs: first, a comparatively high preference for secrecy and independence of the firm's owner-managers and, second, a relatively high dependence of the firm's performance on the value of human capital. These characteristics could explain why SMEs may encounter problems to access external finance. The consequence of asymmetric information is not that lending to SMEs is necessarily a risky business, but that the risk of these firms is more difficult to assess.

Relationship banking and multiple bank-firm relationships can help mitigate information problems between lenders and borrowers. By establishing relationships with firms, banks learn about the firms' prospects and alternative uses of firms' assets. Thus, building a bank-firm relationship is an effective way to partly solve the risk assessment problem. In addition, having a relationship with more than one bank (multiple banking) is a way to restore competition between lenders. Indeed, relationship banking with a single creditor may lead to a captivity problem and, thus, relationship banking in combination with multiple banking may mitigate credit constraints. To investigate whether bank consolidation has affected the availability of credit for French SMEs, we will analyse - in the context of a changing banking sector - the relevance of relationship banking and multiple banking for firms of different sizes.

The performance of small businesses potentially exhibits a higher sensitivity to macroeconomic conditions as they are less diversified in comparison to larger companies. As a consequence, there may be more uncertainty about the performance of small businesses in periods when it is difficult to forecast the future macroeconomic climate. To shed light on this issue, we will focus on the credit risk of SME lending and we will test, in particular, whether and how the availability of credit for SMEs depends on banks' risk assessment.

Banks' risk assessment is changing, not least because of the envisaged changes to the Basel capital adequacy requirements. The current Basel Accord (Basel I) stipulates that international banks must back the total amount of their loans to corporate clients with a capital charge of 8 percent of own funds. Such a rule does not take into account that some corporate clients are riskier than others. As a result, the amount of own funds that Basel I requires for a loan to a corporate client may not correspond to its actual risk. The "economic" capital requirement, i.e. the minimum amount of capital needed to cover losses on a certain type of asset, may be substantially lower for good corporate credits than for bad ones. The proposed new capital adequacy legislation (Basel II) partly corrects for the mispricing of corporate loans inherent in Basel I by allowing international banks to set capital requirements as a function of a firm's credit rating. Moreover, Basel II allows for portfolio diversification effects: the foreseen minimum capital requirement is higher on a portfolio with assets that exhibit higher default correlations. Overall, there is the question whether Basel II will hinder or facilitate lending to small businesses. In light of this question, we will examine the possible implications for SME lending of the implementation of the latest Basel capital adequacy proposal.

A salient feature of the analysis presented in this paper is that it matches firm data with bank data. The firm database allows for SMEs' main characteristics, such as risk or

information opacity, that determine the demand and supply of loans; the bank database allows to account for the characteristics of banks, such as size or membership of a banking group, that may affect the loan supply to small and medium-sized enterprises. In presenting our findings, we proceed as follows. Section 2 describes the French businesses' capital structure and the level of credit risk by firm size. In this context, we will also examine the effect of size on the companies' ability to build a bank-firm relationship and to have more than one relationship. Section 3 analyses the impact of consolidation in the French banking industry on the availability of credit for SMEs. We will see that bank consolidation led to important changes in the market structure for business loans and that there are two main channels through which consolidation has affected credit availability: the bank-firm relationship channel and the risk diversification channel. Section 4 explores the possible implications of a new Basel Accord for SME lending and Section 5 concludes. The Annex presents an econometric model that relates the loan amount received by a firm to characteristics of its relationships with banks while controlling for the size and risk of the firm.

*There are two main channels through which bank consolidation affects credit availability: bank-firm relationships and risk diversification.*

## 2. Capital structure and credit risk of French SMEs

In this section, we will show that the capital structure of French SMEs is quite strong, characterise the nature of bank-firm relationships in France, and argue that - broadly speaking - a diversified portfolio of credits to these businesses is not riskier than a portfolio of credits to large firms. The empirical analysis uses both bank and firm data, coming from two very comprehensive databases (see Box 1): first, a bank database that contains information on all bank loans above EUR 76,000 to individual businesses supplied by all French banks during 1993-2000 and, second, a firm database, covering the same period, that contains balance sheets and income statements for practically all French SMEs (except some very small firms) as well as large firms.

### Box 1. Data sources and size class definition

This paper uses two main databases. One is a firm database provided by the Coface group, a large French credit insurance company, which is also a large provider of financial information on businesses. It contains (i) balance sheets and income statements of individual firms for the period 1993-2000 and (ii) firms' credit ratings - based on the internal rating system of Coface - for the period 1995-2001. The database covers more than 450,000 French SMEs, but excludes those very small firms with an annual turnover lower than EUR 150,000. The second database is the central loan register "Centrale des risques" of the Banque de France. This bank database compiles information on all business loans (commercial and industrial loans) above EUR 76,224 over the period 1993-2000. It contains around 700,000 loans per year.

Following the definition of the European Commission, SMEs are defined for the purpose of this paper as firms with a total turnover of up to EUR 40 million. However, very small firms with an annual turnover lower than EUR 150,000 are not considered. We generally distinguish among four size classes: (i) "very small" firms (annual turnover is less than EUR 2 million but more than EUR 150,000), (ii) "small" firms (turnover between EUR 2 million and EUR 7.5 million), (iii) "medium-sized" firms (turnover between EUR 7.5 million and EUR 40 million), (iv) and "large" firms (turnover exceeding EUR 40 million). All tables and figures except for Table 1 and Figure 1 show data for these size classes; Table 1 and Figure 1 exhibit more than four size classes.

*The capital structure of French SMEs is strong.*

## 2.1 Capital structure

Since the mid-1980s, the ratio of equity to total liabilities of non-financial French firms has increased from around 15 percent to more than 30 percent at the end of the 1990s (CNCT 1999). The underlying strengthening of capital structure applies to SMEs as well as large businesses. Table 1 illustrates the situation for manufacturing firms on the basis of the median firm in each size class: in 2000, the median of the equity ratio hardly varied across size classes; French manufacturing SMEs thus appear to have a sound capital structure and, on average, are not undercapitalised.

However, Figure 1, which presents quartiles and the median of the ratio of equity to total liabilities for each size class, reveals that leverage varies considerably within each size class. Firms in the highest quartile are financed to 50 percent or more with equity whereas firms in the first quartile of the sample finance less than 20 percent of their assets with equity. So, a typical SME does not exist. The leverage of firms differs widely, but firm size does not seem to be a determinant of capital structure.

From Table 1 one can also observe that trade credit plays a major role in business finance, as it is the second largest source of finance after equity. Again, there is no strong evidence that SMEs' use of trade credit differs much from that of large businesses, but there is some indication that SMEs with an annual turnover between EUR 2.5 and EUR 10 million rely more on trade credit than all other firms<sup>1</sup>.

The use of financial debt by French manufacturing firms is relatively low in comparison to their peers in other countries of the European Union. Table 1 shows that the median of the share of financial debt in total liabilities varies between 13 and 15 percent across size classes. Wagenvoort (this volume) finds that SMEs in other European countries on average hold almost twice as much financial debt.

Table 1 also indicates that more than 80 percent of financial debt of SMEs is bank debt whereas in the case of large firms (turnover between EUR 50 and EUR 100 million) and

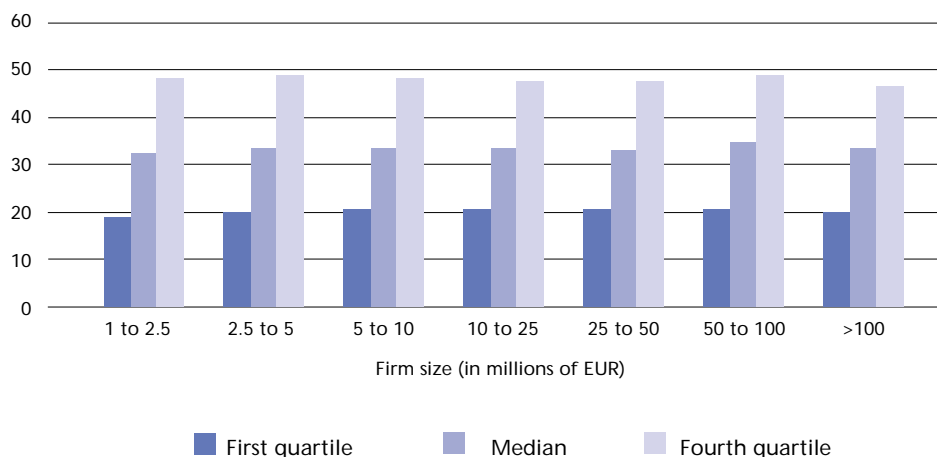
**Table 1. Indicators of capital structure in manufacturing, by firm size, in 2000 (in %)**

Firm size (turnover in EUR million)	Equity/ liabilities	Trade credit/liabilities	Financial debt/liabilities	Bank debt/ financial debt
1 - 2.5	32	25	13	81
2.5 - 5	33	28	14	85
5 - 10	33	28	14	85
10 - 25	33	26	15	83
25 - 50	33	25	15	81
50 - 100	35	25	14	74
> 100	33	25	13	59

Notes: For each indicator, the table shows the value for the median firm in each size class.  
Source: Coface SCRL

1 Dietsch and Kremp (1998) and Delannay and Dietsch (1999) argue that French SMEs rely on trade credit mainly for financial reasons, while large businesses use trade credit for strategic reasons as a means to extract rents from their suppliers in the vertical production-retailing chain.

Figure 1. Distribution of firms' equity ratio, by firm size, in 2000 (in %)



Source: Own calculation based on Coface SCRL

very large firms (turnover larger than EUR 100 million) bank debt represents only 74 and 59 percent of financial debt, respectively. Bank loans are less important for the latter companies as many of them may tap capital markets.

To summarise our main findings on the capital structure of French SMEs, we find that, on average, they are not undercapitalised and their use of financial debt, notably bank loans, is low in comparison to small businesses in other EU countries. This leads to the important question of whether the French banking environment nourishes or rather hampers bank lending to SMEs. In Section 3, we will look more deeply into this issue. To provide background to this analysis, we proceed here with a description of bank-firm relationships in France and credit risk in French companies.

*French SMEs carry relatively little bank loans on their balance sheets.*

## 2.2 Bank-firm relationships and multiple banking

Following recent theory of financial intermediation, an information-opaque company can increase credit availability over time by building a long-term relationship with a bank. Indeed, through such a relationship, the bank acquires information about the risk and quality of the borrower, making the bank more willing over time to lend to such a business. However, this positive effect of relationship banking on credit availability diminishes if the bank extracts a monopoly rent from the customer. Due to the private nature of the information acquired by the bank, the firm may become captive to its bank. As a consequence, firms may need to borrow from several banks to prevent each bank from gaining market power. Thus, when problems of asymmetric information are relevant, the optimal strategy for firms may be to establish long-term relationships with more than one bank.

Following this logic one could expect that both the number of bank-firm relationships and the length of bank-firm relationships decrease with firm size because smaller firms are more likely to suffer from information problems than larger firms. However, the following results show that, for France, this is not at all the case.

**Table 2. Number of bank-firm relationships, by firm size, 1993-2000**

	Size class (turnover in EUR million)			
	Very small ( $\leq 2$ )	Small ( $2 < \# \leq 7.5$ )	Medium-sized ( $7.5 < \# \leq 40$ )	Large ( $\# > 40$ )
1993	1	1	2	3
1994	1	1	2	3
1995	1	1	2	3
1996	1	1	2	3
1997	1	2	2	3
1998	1	2	3	4
1999	1	2	3	4
2000	1	2	3	4

Notes: For each size class, the table shows the median number of bank-firm relationships. To be precise, the number of relationships reflects the number of relationships with banking groups rather than banks.

Source: Own calculations based on Banque de France data.

Firstly, as Table 2 shows, the occurrence of multiple banking increases with firm size. In 2000, the median very small firm in France obtained credit from only one creditor whereas large firms had, on average, loans outstanding at four credit institutions. Table 2 clearly shows that the number of banks increases monotonically with company size. One can also observe that the number of banks increased over the period for all size classes except for very small firms.

*Smaller firms have fewer and shorter bank relationships than larger firms.*

Secondly, Table 3 reveals that the length of the bank-firm relationship also increases significantly with firm size. Unfortunately, we do not have data on the actual duration of bank-firm relationships. Duration is measured here as the number of successive years during which the company received loans from the same banking group over the period under review, i.e. 1993-2000. Therefore, by construction, maximum duration is eight years. Evidently, in practice, many firms will stay with their creditor(s) for more than eight years. However, our measure still provides a valid comparison between firms in different size classes with respect to their willingness and/or capacity to stay with the same creditor. We find that, during this period, very small firms on average did not stay longer than about 3 years with the same bank whereas large firms on average kept relationships for about 5 years. We recall from Table 2, however, that large firms maintain more than one relationship at the same time. It may thus well be that large firms kept a relationship for the whole period with one or several of their main creditors, the so-called house banks, while changing their less important creditors relatively frequently. Thus, an average

**Table 3. Average duration (in years) of bank-firm relationship in 1993-2000, by firm size**

Size class (turnover in EUR million)	First quartile	Median	Fourth quartile
Very small ( $\leq 2$ )	2	3	4
Small ( $2 < \# \leq 7.5$ )	2	4	5
Medium-sized ( $7.5 < \# \leq 40$ )	3	5	7
Large ( $\# > 40$ )	3	5	8

Notes: By construction, maximum duration is 8 years.

Source: Own calculations based on Banque de France data.



duration of five years does not imply that large firms suspended the relationship with all their banks at least once during the eight-year period 1993-2000. The far right column of Table 3 shows that a quarter of large firms did not end any of their relationships that existed in 1993 since the duration for this group of firms is eight years.

The results shown in Table 3 are somewhat in contradiction with the traditional belief that relationship banking creates more value for small, information-opaque firms than for large, more transparent ones. However, one caveat is worth mentioning. In Table 3 we do not control for differences in age. If the share of firms that existed for less than eight years is substantially higher among SMEs than among large firms, the observed shorter duration of relationships in the case of small firms may simply be because they had less time to build relationships. But it is unlikely that differences in the age structure across size classes can fully explain differences in the duration of bank-firm relationships because the data set includes a substantial number of SMEs that were more than eight years old. Bearing this in mind it is striking to observe that even for the upper quartile, duration increases with size. But why would smaller French firms keep shorter and fewer bank relationships?

One can approach this question both from the demand side and the supply side of credit. Starting with the demand side, we note that establishing a relationship with a bank imposes fixed costs on firms and, thus, adding a new creditor to the list of a firm's financial intermediaries will trigger additional fixed costs. For small firms it is more costly to establish multiple bank relationships than for large firms because small firms have to spread the fixed costs of lending over a smaller loan amount. Therefore, smaller firms may be less willing to borrow from several banks at the same time, implying that the results shown in Table 2 are demand driven. As mentioned above, the disadvantage of having only one bank is that the bank may turn into a monopolist over time. Although it is expensive for smaller firms to provoke competitive behaviour of banks by maintaining multiple relationships, smaller firms may still break monopolies by switching bank in the course of time. This could explain the relatively short duration of bank-firm relationships in the case of smaller firms. So, the results summarised in Table 3 could be demand driven as well. This reasoning implies, however, that the value of relationship banking is smaller than the value of fierce competition between lenders. In other words, the positive effect of building a bank-firm relationship that results from a reduction of information asymmetry is more than offset by growing market power of the bank.

*Smaller firms may switch banks more often to reduce the monopoly power of banks.*

With regard to supply-side explanations, the lower number and shorter duration of bank-firm relationships in the case of small firms could be explained by credit rationing: creditors are more likely to turn down small firms than large ones. We will return to this possibility in Section 3 when analysing whether differences in the capacity or willingness to diversify creditors and to increase the length of banking relationships affects the availability of credit.

### **2.3 Is lending to French SMEs risky business?**

The credit risk on a portfolio of loans depends broadly speaking on two variables: (i) the probability of default (PD) of the individual loans and (ii) the correlations between individual default probabilities. Higher correlations imply that it is more likely that loans default at the same time. A loan portfolio with high default correlations is thus riskier than one with low default correlations. Diversifying a portfolio means adding loans with low or even negative default correlations. For instance, loans to firms operating in different

industry sectors will normally exhibit lower default correlations than loans to firms within the same sector. The dependence of default probabilities on macroeconomic conditions will also determine the extent to which credit risk can be diversified. For example, suppose that all firms are profitable when the economy is good and suffer losses when the economy is bad. But suppose further that the performance of small firms is more sensitive to the business cycle than the performance of large firms in the sense that small firms make higher profits (losses) in a boom (during a recession) than large firms. In these circumstances, a portfolio of loans to small businesses will be riskier than a portfolio of loans to large companies. Indeed, the default correlations in the latter portfolio will be lower since large firms react less strongly to changes in macroeconomic conditions. In these circumstances, the idiosyncratic risk, i.e. the risk that can be diversified, will be more important relative to the systematic (macroeconomic) risk for large firms than for small firms.

In answering the question whether lending to French SMEs is risky business - that is, compared to lending to large firms - we need to account for both the probability of default of the individual loans and the correlations between individual default probabilities. In what follows, we use a simple one-factor model of portfolio credit risk (see Box 2). "One-factor" means that PDs and correlations of individual PDs depend on only one variable - the general state of the economy in our model. We have estimated stationary PDs, i.e. the weighted average of annual PDs over the period 1995-2001, and default correlations using the internal rating system and database of Coface (see Box 1).

*Considered in isolation, a small firm is riskier than a large one.*

Our results, summarised in Table 4, strongly indicate that the average PDs decrease with firm size: as the last row shows, the average PDs decrease monotonically from 2.6 percent for very small firms to 0.3 percent for large enterprises. So, on average, a stand-alone credit to a French SME is far riskier than a credit to a large enterprise. Table 4 distinguishes eight rating classes, ranging from class 1 (= low risk) to class 8 (= high risk). By way of illustration, note that large firms in rating classes 5 and 6 are expected to default once in a hundred years as their PDs are approximately equal to 1 percent.

Table 5 indicates how firms' credit standing has evolved over time. For the average firm in each size class, the Coface credit rating decreased sharply and, thus, credit risk fell over the

**Table 4. Average default probabilities of French firms (in %), 1995-2001**

Risk classes	Size class (turnover in EUR million)				SMEs ( $\leq 40$ )
	Very small ( $\# \leq 1$ )	Small ( $1 < \# \leq 7.5$ )	Medium-sized ( $7.5 < \# \leq 40$ )	Large ( $\# > 40$ )	
1 (low risk)	0.3	0.2	0.2	0.03	0.2
2	0.4	0.3	0.2	0.1	0.3
3	0.9	0.7	0.5	0.1	0.7
4	1.6	1.4	0.8	0.4	1.3
5	2.8	2.6	1.5	1.1	2.4
6	4.9	4.5	2.4	1.1	4.2
7	10.0	9.4	5.5	2.3	8.6
8 (high risk)	14.9	16.2	13.3	*	13.8
<b>Total</b>	<b>2.6</b>	<b>1.7</b>	<b>0.8</b>	<b>0.3</b>	<b>2.2</b>

Notes: Default is defined as legal bankruptcy; \* = no default in this class.  
Source: Coface SCRL and own computations.

period 1994-2000. Favourable economic conditions during the second half of the 1990s strengthened the quality of the loan portfolios of French credit institutions regardless of bank consolidation. As a result, in 2001, almost 40 percent of SMEs were in the second-lowest risk class of the Coface credit rating, which corresponds to an average probability of default of 0.32 percent (Figure 2). More generally, Figure 2 shows that some 60 percent of SMEs are in low-risk classes, with an average PD below 0.72 percent.

We now turn to the correlation between default probabilities and thus assess the scope for diversification. Table 6 presents default correlations between firms of the same size for a given risk class. Three main results stand out. Firstly, default correlations of loans to French firms are very small. The average value is 0.013 and 0.022 for SMEs and large firms, respectively. The maximum value, which is indeed a striking outlier, is observed for medium-sized firms in rating class 8, i.e. borrowers close to default. Secondly, on average,

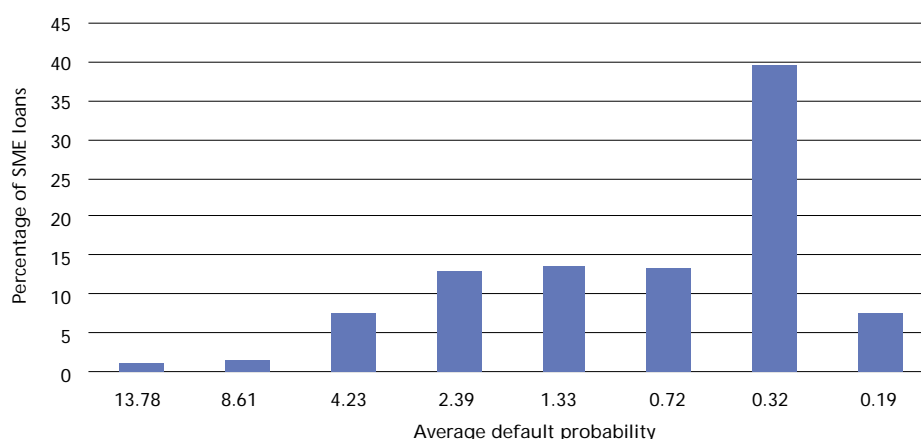
**Table 5. Average credit rating of business loan portfolios, by size class, in 1994-2000**

	Size class (turnover in EUR million)			
	Very small (# ≤ 1)	Small (1 < # ≤ 7.5)	Medium-sized (7.5 < # ≤ 40)	Large (# > 40)
1994	4.2	3.7	3.3	2.8
1995	4.1	3.6	3.2	2.7
1996	4.1	3.6	3.3	2.7
1997	4.1	3.7	3.3	2.7
1998	4.1	3.7	3.3	2.7
1999	3.8	3.4	3.1	2.5
2000	3.7	3.4	3.1	2.4

Notes: Risk classes range from 1 (=low risk) to 8 (=high risk).

Source: Coface and own computations.

**Figure 2. Distribution of SME loans over risk classes (in %) in 2001**



Notes: The risk class to the extreme left corresponds to Coface rating class 8 (=high risk); the average PD of loans in this risk class is 13.78 percent. The risk class to the extreme right corresponds to Coface rating class 1 (=low risk); the average PD of loans in this risk class is 0.19 percent.

Source: Coface SCRL and own computations.

## Box 2. Computation of default correlations

### Methodology

We compute default correlations within a one-factor ordered probit model (see Gordy 2000, and Dietsch and Petey 2002). The same methodology also serves to calibrate the proposed Basel II risk weights formulas (see section 4).

In this model, by definition, borrower  $i$  will default if the latent (unobserved) random variable  $U_i$  is smaller than  $\Phi^{-1}(\bar{p}_{rs})$ , where  $\Phi(\cdot)$  is the cumulative distribution function of the standard normal distribution and  $\bar{p}_{rs}$  is the stationary (average) probability of default corresponding to a firm with a rating  $r$  ( $r = 1, \dots, R$ ) in size class  $s$  ( $s = 1, \dots, S$ ). In this paper we consider four different size categories ( $S = 4$ ) and eight rating categories ( $R = 8$ ). The latent random variable  $U_i$  is assumed to be normally distributed and is defined as a function of a single systematic factor  $x$  and a specific idiosyncratic factor  $\varepsilon_i$ :

$$(1) U_i = w_{rs}x + \sqrt{1 - w_{rs}^2} \varepsilon_i$$

where  $x$  and  $\varepsilon_i$  are independent standard normal random variables and  $w_{rs}$  is an unknown parameter. The systematic factor  $x$  represents the state of the economy. The parameter  $w$  measures the sensitivity of borrower  $i$ 's performance to the business cycle and is bound to the interval  $[-1, 1]$ . We note that this sensitivity may differ depending on the rating and size of the borrower. Higher values for  $w$  signal that the performance of firms in the same rating and size class will exhibit more similarity since firms within that group are more sensitive to the state of the economy. Putting it differently, as  $w_{rs}$  decreases, the performance of borrowers with rating  $r$  and of size  $s$  tend to be less correlated as the idiosyncratic risk component  $\varepsilon_i$  becomes more important.

In extension, the degree of correlation between defaults of borrowers is determined by the parameter  $w$ . More precisely, for two borrowers  $i$  and  $j$  belonging to the same size class and with the same rating grade, the correlation between their latent variables is equal to:

$$(2) \text{Corr}[U_i; U_j] = \frac{E[U_i U_j] - E[U_i]E[U_j]}{\sqrt{\text{var}(U_i)} \sqrt{\text{var}(U_j)}} = w_{rs}^2.$$

Therefore, the correlation between individual defaults is fully explained by the sensitivity of borrowers to aggregate shocks in the economy.

How to compute the parameter  $w$ ? Using (1) we derive that a borrower defaults if:

$$(3) \varepsilon_i < \frac{\Phi^{-1}(\bar{p}_{rs}) - w_{rs}x}{\sqrt{1 - w_{rs}^2}}.$$

From (3) one can observe that any variation in  $x$ , the systematic factor, induces a variation in the PD of borrower  $i$  if  $w$  is not equal to zero. Under the assumption that the idiosyncratic component  $\varepsilon_i$  is standard normally distributed, the PD of borrowers with rating  $r$  and of size  $s$ , conditional on the realisation of the systematic factor  $x$ , is equal to:

$$(4) p(x)_{rs} = \Pr \left[ \varepsilon_i < \frac{\Phi^{-1}(\bar{p}_{rs}) - w_{rs}x}{\sqrt{1 - w_{rs}^2}} \right] = \Phi \left[ \frac{\Phi^{-1}(\bar{p}_{rs}) - w_{rs}x}{\sqrt{1 - w_{rs}^2}} \right].$$

Dietsch and Petey (2002) show that if the realisations of the systematic factor are independent, the variance of the conditional PD  $p(x)_{rs}$  is equal to:

$$(5) \quad \text{Var}[p(x)_{rs}] = \text{bivnor}(\Phi^{-1}(\bar{p}_{rs}), \Phi^{-1}(\bar{p}_{rs}), w_{rs}^2) - \bar{p}_{rs}^2$$

where *bivnor* is the probability density function of a bi-variate normal distribution. Once the left-hand-side of equation (5) is approximated with the help of the non-parametric method proposed by Gordy (2000), we can derive *w* as a solution to equation (5).

So, to calculate default correlations, i.e. correlations between the latent variables, we compute, first, annual PDs by applying a one-year horizon rating transition matrix to 32 different types of borrowers: (3 SME size classes + 1 large-firm class)  $\times$  (8 risk classes). Second, for each size-risk class we compute stationary PDs by averaging these annual PDs over time; we thus obtain 32 different values for  $\bar{p}_{rs}$ . Third, we estimate the variance of the conditional PD,  $\text{Var}[p(x)_{rs}]$ , for each borrower class using Gordy's approximation method. Fourth, 32 values of *w* are computed by using equation (5). Finally, correlations are computed with equation (2).

### Discussion

First, the Coface database to which we apply our credit risk model covers a rather short time period since it includes only one part of the business cycle. Economic conditions in France were relatively favourable during the time period 1995-2001. As a consequence, stationary PDs and default correlations as reported in Dietsch and Petey (2002) and in this paper are lower than one would expect to observe over a longer period. Second, a simple but elegant one-factor model has its drawbacks. Our methodology implies that default correlations only vary across a relatively small number of rating and size classes. Within each size-rating class, default correlations are the same for each borrower. This is a rather strong result as one may expect that other factors, such as industry affiliation, play an important role. Indeed, one cannot expect a rating system to be a perfect screening device for distinguishing firms with different default correlations.

default correlations decrease significantly with size for SMEs but, at the same time, correlations are higher for large firms. This result shows that the performance of medium-sized firms is less sensitive to the systematic risk factor than the performance of very small and small firms and that the SME group as a whole is less sensitive to macroeconomic conditions than the group of large firms. In other words, credit risk can be better diversified for SMEs than for large firms.<sup>2</sup> Thirdly, for a given size class of firms, default correlations do not necessarily show a negative or positive relationship when moving from a low-risk to a high-risk class. For example, the default correlation increases with risk of default in the sub-sample of very small firms whereas the relation between default correlation and risk of default is "U-shaped" for the other two classes of SMEs.

2 To assess the likelihood of relatively high default correlations in the case of large firms, confidence intervals around average correlations were built by drawing random portfolios for each size-risk class. The size of the portfolios is chosen in accordance with the respective size of the borrowers. After all, the size of the portfolio may determine the default correlations. Simulated SME portfolios comprise 5,000 borrowers whereas simulated large-firm portfolios only 2,000. Portfolio size is kept constant over the period by replacing firms in default by new firms. Results show that the standard deviation increases with size. Volatility is especially high in the case of large firms. This means that it is more difficult to estimate default correlations for large firms than for SMEs. However, we still find that correlations are higher for large firms than for SMEs. For details, see Dietsch and Petey (2003).

**Table 6. Default correlations between French firms, 1995-2001**

Risk class	Size class (turnover in EUR million)				
	Very small (# ≤ 1)	Small (1 < # ≤ 7.5)	Medium-sized (7.5 < # ≤ 40)	Large (# > 40)	SMEs (≤ 40)
1 (low risk)	0.008	0.030	0.028	0.015	0.022
2	0.001	0.020	0.016	0.000	0.023
3	0.016	0.006	0.007	0.044	0.023
4	0.013	0.010	0.006	0.028	0.027
5	0.015	0.010	0.004	0.028	0.015
6	0.018	0.015	0.008	0.000	0.020
7	0.027	0.021	0.021	0.000	0.030
8 (high risk)	0.027	0.028	0.107	0.000	0.031
<b>Total</b>	<b>0.015</b>	<b>0.010</b>	<b>0.005</b>	<b>0.022</b>	<b>0.013</b>

Source: Coface SCRL and own computations

We should emphasise the limits of our measurement of default correlations (see also Box 2). Default correlations could be underestimated for two main reasons. First, the time period under consideration might be too short to cover an entire business cycle, and this could induce a bias in the measurement of PDs, the volatility of PDs, and default correlations. Second, the estimated correlations were computed on a very large sample, i.e. almost all business loans in France are included. In general, the size of the SME portfolios of French credit institutions is lower, and the size of the portfolio may determine the effective values of correlations in the loan book.

*From a credit risk portfolio viewpoint, loans to smaller firms are not necessarily riskier than loans to larger firms.*

To summarise, our results confirm the widespread belief that an SME is more likely to default than a large company. But, contrary to conventional wisdom, we also find that SMEs are relatively insensitive to macroeconomic conditions and that it is less likely to find high default correlations for a portfolio of SME loans than for a portfolio of loans to large enterprises. All in all, while individual SMEs are riskier than large firms, a portfolio of SME loans is not necessarily riskier than a portfolio of loans to large firms since idiosyncratic risks can be diversified.

### 3. Consolidation in the French banking sector and credit supply

This section starts with a description of the main changes in the French business loan market that accompanied bank consolidation in the 1990s. Subsequently, we will assess whether bank consolidation has had an impact on the availability of credit for SMEs by focusing on the two mechanisms that we described in detail in the previous section, i.e. the effect of bank-firm relationships and portfolio credit risk considerations on the supply of SME loans.

#### 3.1 Bank consolidation and business loan market

Due to mergers and acquisitions in the second half of the 1990s, the number of key players in the French banking industry had fallen to seven by 2000, namely Banques Populaires-Natexis, BNP-Paribas, Caisses d'Épargne, Crédit Agricole-Indosuez, Crédit Lyonnais, Crédit Mutuel-CIC, and Société Générale. These groups adopted different strategies during the

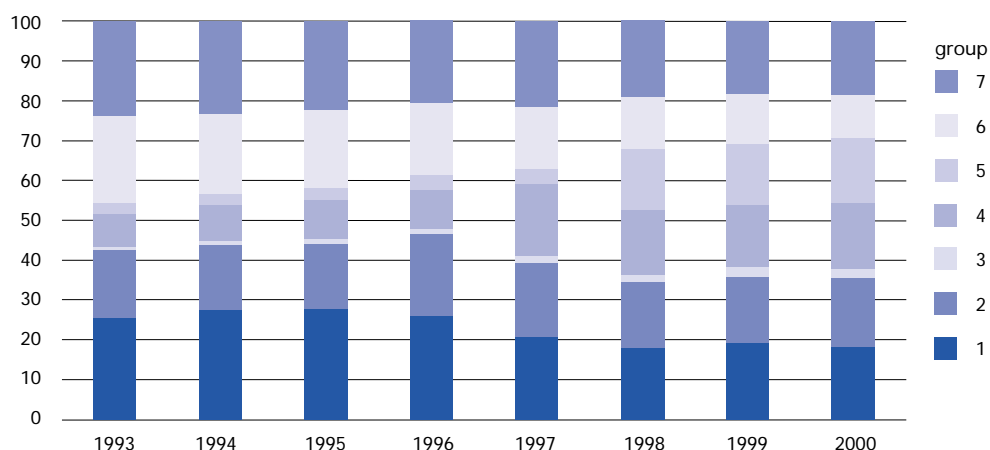
*Bank consolidation has stimulated competition in the business loan market.*

1990s, some of them favouring the supply of new financial services to large corporate firms, while others focused on the retail market, including small business loans (Dietsch and Golitin 2002). A major consequence of these divergent strategies was a reallocation of banks' market shares in the business loan market. Indeed, as Figure 3 shows, the number of dominant players increased from four at the beginning of the 1990s to six at the end of this period. Interestingly, in 2000, the six most important banking groups share the business loan market almost equally.<sup>3</sup> In other words, banking consolidation did not increase concentration in the business loan market and actually lowered the top-four-bank asset concentration level.

Bank consolidation often raises concerns that large banks might favour larger firms at the expense of smaller firms, thus reducing the participation of banks in the SME loan market segment. In the case of France, these concerns have proved to be unfounded and, in fact, we find the opposite result: as Figure 4 shows, the share of SMEs in the business loan market has increased significantly during the 1990s. This applies especially to very small and small businesses; the former almost doubled their share in total business loans (from 3.0 percent to 5.4 percent) and the latter achieved an increase of close to 40 percent (from 9.6 percent to 13.2 percent). During the same period, the share of loans to large firms fell by 8 percentage points, starting from a share of almost two-thirds in 1993.

In addition to the data shown in Figure 4, we observe that, in 1999, SMEs obtained about 40 percent of total company loans, which is equivalent to their share in overall investment in the French economy (see Section 1). This suggests that SMEs got their fair share of the bank loan market. One should bear in mind, however, that SMEs usually have only few options when raising external finance. Their share in the total amount of debt finance, including market debt finance such as bonds, could still be low compared to the debt

**Figure 3. Banking groups' market share in the outstanding business loan market (in %)**

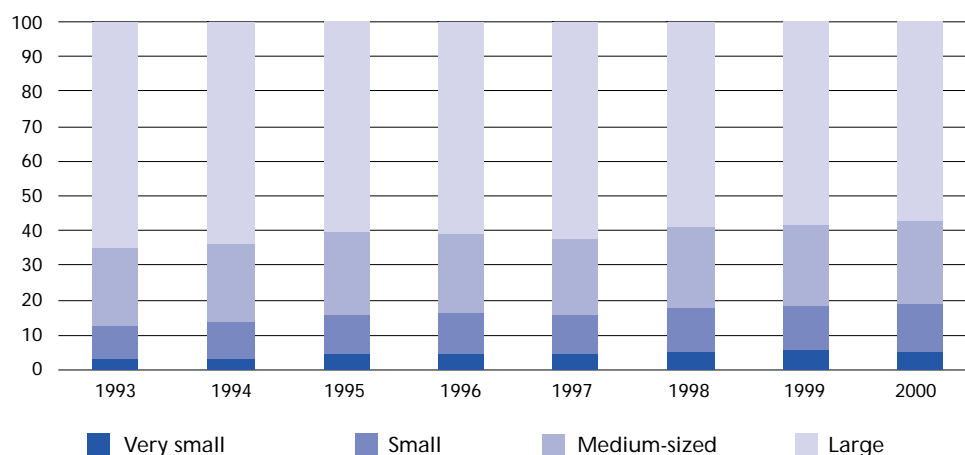


Notes: Groups 2 to 5 represent mutual banks and groups 1, 6 and 7 corporate banks.

Source: Banque de France and own calculations.

<sup>3</sup> We note that this analysis is restricted to firms belonging to three sectors of the French economy: manufacturing, retail, and transport. Loans from the seven banking groups to these sectors represent almost 90 percent of the total volume of the business loans in our sample.

Figure 4. Outstanding loans to enterprises, by size class, in % of total



Notes: For definition of size classes see Table 2.  
Source: Banque de France and own calculations.

finance made available to large firms. Finally, one cannot conclude from Figure 4 that individual small businesses have indeed obtained more loans from their banks since, as shown below, the composition of the SME population has also changed over that period.

### 3.2 Bank consolidation, bank-firm relationships, and SME credit availability

In Section 2 we found that smaller firms in France have shorter and fewer bank-firm relationships than larger firms. In this section, we will investigate whether the duration and the number of bank-firm relationships have an impact on credit availability. Before turning to the empirics, we should ask what theory predicts. It is fair to say that there is no real consensus on the relationship between the duration and number of bank-firm relationships, on the one hand, and credit availability on the other hand. As argued above, market power can offset the positive effect of acquiring more and better information about borrowers as a result of longer relationships. Regarding multiple banking there are also two possible forces at work. For one thing, multiple banking may increase the probability of a firm being credit rationed because the value of the existing bank-firm relationship may drop when relationships with additional lenders are being built (information opacity hypothesis<sup>4</sup>). For another, multiple banking may decrease the probability of credit rationing because of risk sharing among lenders (diversification hypothesis<sup>5</sup>). Thus, empirical analysis is required to determine which factors dominate.

To start with the effect of multiple banking on credit availability, we recall from Table 2 that the number of relationships firms have with banks has increased, possibly due to the changes in the structure of the banking industry. Table 7 suggests that the increase in multiple banking did not harm the overall level of bank lending: for the average firm, the total amount of loans by all banking groups slightly increased (see the extreme-right

4 Thakor (1996), Berger and Udell (1998), Berger *et al.* (2001), De Bodt *et al.* (2002).

5 Detragiache *et al.* (2000).

*A priori, the impact of the number and duration of bank-firm relationships on credit supply is unclear.*



**Table 7. Average loan amount supplied to French firms, 1993-2000**

	Size class (turnover in EUR million)									
	Very small (# ≤ 2)		Small (2 < # ≤ 7.5)		Medium-sized (7.5 < # ≤ 40)		Large (# > 40)		All firms	
	Average loan amount (in EUR million)									
	Per bank Total		Per bank Total		Per bank Total		Per bank Total		Per bank Total	
1993	0.3	0.4	0.4	0.6	0.8	1.7	5.3	16.8	1.3	3.5
1994	0.3	0.4	0.4	0.6	0.7	1.6	5.1	16.3	1.2	3.3
1995	0.3	0.4	0.3	0.6	0.7	1.7	4.8	14.9	1.1	2.9
1996	0.3	0.3	0.3	0.6	0.7	1.7	4.7	15.6	1.1	2.9
1997	0.2	0.3	0.3	0.5	0.7	1.8	5.1	20.0	1.0	3.2
1998	0.2	0.3	0.3	0.6	0.7	2.1	5.0	21.4	0.9	3.3
1999	0.2	0.3	0.3	0.7	0.8	2.3	5.5	24.2	1.0	3.4
2000	0.2	0.3	0.4	0.7	0.9	2.5	5.8	25.7	1.0	3.7

Source: Banque de France and own computations

column of Table 7). With the exception of very small firms, French businesses simultaneously increased the number of intermediaries they borrow from (Table 2) as well as their volume of credit (Table 7). The average very small firm, which did not extend its bank base, did not receive more credit. The relative change in the number of creditors was the most important for small firms (annual turnover between EUR 2 and 7.5 million) given that for these firms the median number of banks doubled from 1 to 2 (whereas medium-sized firms went from 2 to 3 bank relationships and large firms from 3 to 4). However, over the period 1993-2000, the average total amount of loans obtained by small firms increased only moderately. By contrast, medium-sized firms and large-scale enterprises experienced, on average, a substantial increase (about 50 percent) in annual bank lending. Overall, from Table 7 it remains unclear whether multiple banking actually enhances credit availability.

A further comment is worth making. Table 7 reveals that, on average, very small firms did not obtain more credit in 1993 than in 2000 whereas medium-sized and large firms did. At first sight, this seems to contradict Figure 4, which shows that very small firms have almost doubled their market share in the business loan market whereas the share of large firms fell considerably. We therefore deduce from Figure 4 and Table 7 that the number of very small firms that successfully applied for a bank loan must have increased during the 1990s. Thus, despite a constant average loan amount, the number of very small firms receiving a loan in 2000 must have been substantially larger than in 1993.

To investigate the relationship between credit availability and multiple banking more formally, we performed a regression analysis (see Annex). With a regression model we can control for simultaneous effects of different factors (such as the firm's credit rating, its size, and the duration of the bank-firm relationship) when testing the effect of multiple banking on the loan amount. Estimation results associated with our econometric model, which explains the ratio of the annual loan amount from one lender to the firm's turnover, show that the number of bank-firm relationships has a positive and significant effect. This

*Our empirical evidence suggests that multiple banking increases credit availability.*

positive relationship between the volume of credit and multiple banking holds true regardless of firm size. However, the magnitude of the impact of multiple banking monotonically decreases with firm size (i.e., the regression coefficients are higher for smaller firms than for larger firms) irrespective of the change in the number of bank-firm relationships (from 1 to 2, from 1 to 3 etc.). In other words, smaller firms can enhance credit availability to a larger extent than larger firms when increasing the number of lenders!

*Our findings also suggest that a longer bank relationship increases credit availability more for small firms than for large firms.*

Turning to the impact of the duration of a bank-firm relationship on credit availability, we see from Table 8 that across all size classes, credit availability for the average firm improves with the length of the relationship between the firm and its main lender. As the results of our econometric model (summarised in Table A1 of the Annex) indicate, this positive relationship remains even when controlling for other factors, such as the number of relationships. The econometric results further show that the impact of the duration of bank-firm relationship on credit availability is much larger for smaller firms than for larger ones: smaller firms benefit most from maintaining a longer relationship.

**Table 8. Duration of main bank-firm relationship and average loan amount (in EUR million) in 2000**

Length of relationship (in years)	Size (turnover in EUR million)			
	Very small (# ≤ 2)	Small (2 < # ≤ 7.5)	Medium-sized (7.5 < # ≤ 40)	Large (# > 40)
1	0.2	0.2	0.6	4.3
2	0.2	0.3	0.7	3.6
3	0.3	0.3	0.8	4.4
4	0.2	0.4	0.8	5.5
5	0.3	0.4	0.8	5.6
6	0.3	0.4	0.9	8.2
7	0.3	0.4	0.9	5.7
8	0.3	0.5	1.2	7.2

Source : Banque de France and own computations

To summarise, an increase in multiple banking accompanied the consolidation of the French banking industry. Our econometric estimates suggest a positive link between credit availability and multiple bank-firm relationships and they also show that the smaller the firm, the stronger the link. Except for the very small firms, SMEs have increased the number of their relationships with banks by more, in relative terms, than large firms. In view of these two observations (both the impact of multiple banking and the change in the number of banks is larger in the case of SMEs), one could have expected the total loan amount per firm to increase faster in small and medium-sized firms than in large firms. This, however, was not the case for the average small firm that experienced only a moderate improvement in its overall credit volume. When investigating the impact of credit risk below, we will argue that this is likely to be the outcome of small firms' choice rather than credit rationing. Our regression analysis also shows a strong positive link between the duration of a bank-firm relationship and the amount of credit supplied. Also here smaller firms are more sensitive than larger ones to the duration of their bank

relationships. Smaller firms tend to keep shorter banking relationships and this has a disproportionate effect on their credit availability. We conclude that both relationship banking and multiple banking can create value.

### 3.3 Bank consolidation, credit risk, and SME credit availability

The second mechanism through which consolidation could have affected the availability of credit to SMEs is portfolio risk diversification. French banking consolidation went together with a significant decrease in credit risk, which was the consequence of good economic conditions during the period under review. In addition, due to diversification effects, bank mergers further reduced the overall risk on business loan portfolios. Indeed, the increasing preference for multiple banking tends to produce a better risk sharing between competing banking groups. As the data for “all firms” in Table 7 indicate, the average loan amount per bank dropped from EUR 1.3 to 1 million between 1993 and 2000, suggesting that each banking group reduced its average exposure to a single borrower.

*Bank consolidation has led to better risk sharing among lenders.*

A more formal Value at Risk (VaR) analysis shows that acquiring banking groups could reduce their risk profile through acquisitions. Therefore, consolidation produced significant benefits to the overall French banking sector with regard to risk diversification. The VaR on a loan portfolio is equal to the maximum potential loss that can occur with a given probability for a given time horizon<sup>6</sup>. In this paper, we measure the diversification benefit that consolidation generates as the difference between the VaR of the business loan portfolio of the acquiring bank before and after the acquisition. The VaR number is expressed here as a percentage of the total value of credit. In other words, diversification gains are measured as the variation in the required “economic capital” (see Section 1) as a percentage of total credit outstanding. Table 9 shows that out of nine acquiring banking groups, eight banks experienced lower economic capital requirements on their (increased) business loan portfolio after the bank merger took place. The reduction ranged from 3 to 21 percent of the original VaR figure. However, in one case, the bank merger led to an increase in the VaR of the acquiring bank. In this case, the VaR of the acquired portfolio was higher than the VaR on the existing portfolio and diversification effects were not strong enough to compensate the higher risk on the new assets. The remainder of this section aims at analysing the consequences of risk diversification on the credit availability for SMEs.

More specifically, the question is whether risk diversification gains realised by banks benefited SME financing. Distinguishing different size and (Coface) rating classes, Table 10 presents the median amount of loans (in proportion to turnover) that the average firm in each size-rating class obtained from its banks in the year 2000<sup>7</sup>. Due to the higher dependence of SMEs on bank debt, the ratio of loans to turnover, in general, decreases with size.<sup>8</sup> For example, the average very small firm of the highest quality (i.e. with a credit rating of 1) received loans equal to 84 percent of its turnover whereas the average large firm of the highest quality obtained an amount of loans equal to only 15 percent of

<sup>6</sup> We note that only firm-specific (idiosyncratic) risks can be diversified. Therefore, the Value at Risk of a loan portfolio asymptotically approaches the general (systematic) risk.

<sup>7</sup> We obtained similar results for other years.

<sup>8</sup> The exceptions are: going from medium-sized to large enterprises with a credit rating of 2, 5 and 7.

**Table 9. Diversification effect observed at the acquiring bank after acquisition**

Acquiring banking group	VaR (in % of business loan portfolio)		Gain in VaR (in %)
	Before	After	Relative Difference
A	1.7	1.5	-8
B	1.8	1.6	-13
C	2.0	1.8	-9
D	2.2	2.1	-3
E	2.2	2.1	-7
F	2.3	2.6	13
G	2.5	2.4	-4
H	2.5	2.0	-21
I	2.7	2.3	-16

Notes: VaR is computed as the difference between the mean value and the value of the 99 percentile of the probability density function of loan losses.

Source: Banque de France, Coface rating system, and own computations.

**Table 10. Ratio of annual loan volume to turnover, by size class and rating class, in 2000**

Risk class	Size (turnover in EUR million)			
	Very small (# ≤ 2)	Small (2 < # ≤ 7.5)	Medium-sized (7.5 < # ≤ 40)	Large (# > 40)
1 (low risk)	84	20	15	5
2	25	15	14	15
3	27	17	16	15
4	29	18	16	14
5	27	18	16	18
6	34	20	18	16
7	28	19	13	78
8 (high risk)	24	19	12	*

Notes: Table reports median values; \* no observation.

Source: Banque de France and own computations.

its turnover. Results show that the supply of loans seems to be more sensitive to the level of risk (as measured by the credit rating) in the case of very small SMEs than in the case of small and medium-sized firms. Indeed, very small, high quality firms get significantly higher amounts of loans than very small firms of lesser credit quality, whereas for other SME size classes the amount of loans clearly varies less with the credit rating.

We have introduced two variables in our econometric model of credit availability (see the Annex) to measure the impact of default risk and risk diversification on the availability of loans. The Coface rating class of the borrower measures default risk, and the degree of attainable risk diversification is measured by the size of the business loan portfolio of the lending bank (see Annex for an explanation of the explanatory factors).

The estimation results, reported in Table A1 in the Annex, show that the firm's default risk level significantly affects SME credit availability. In general, a lower default risk creates better opportunities for SMEs to raise funds from banks. In line with Table 10, the effect

is the strongest for the very small firms with the lowest credit risk since the regression coefficient for this group is by far the largest. For all rating classes, the positive effect of moving to a higher grade (lower risk) is more important for very small firms than for other larger SMEs. Although some small and medium-sized firms also profit from better credit availability when their credit status is upgraded, especially when they leave risk classes 7 and 8 for a better rating, we find for the small firms with a rating of 2 or 3 (low credit risk) that the effect can be significantly negative. Moreover, for these two rating classes the effect is not significantly different from zero for the medium-sized and large enterprises. In fact, for large firms, we find a positively significant effect only for firms with a rating of 1 or 6. This suggests that higher quality firms, except the very small ones, tend to have other financing opportunities in addition to bank loans. These firms do not necessarily want to borrow more from banks as their credit rating improves. In this case, credit availability is not influenced by the firm's risk level. We conclude that a better grade (lower risk) improves credit availability of very small firms regardless of their previous credit rating; it improves credit availability for small, medium-sized and large firms with high initial credit risk; but is largely irrelevant for small, medium-sized and large firms with a more moderate risk profile (i.e. a Coface rating equal to 5 or lower).

*For the large majority of French SMEs, credit availability is not influenced by their credit risk rating.*

As to the effect of our proxy for scope of diversification, i.e. the portfolio size of the lending bank, our econometric results show that the effect is significantly positive only for the group of very small firms. This means that credit availability increases when the bank has the opportunity to diversify credit risk on very small exposures by holding a larger portfolio. However, the sign of this portfolio size variable is significantly negative for the other firm size classes. Our interpretation of this finding is that either diversification gains associated with banking consolidation were too weak to really affect the banks' lending policy, especially with respect to SMEs, or that the time elapsed after French bank consolidation is still too short for banks to have extracted these gains.

To conclude, consolidation of the French banking sector has led to better access to the credit market, especially for SMEs. The number of very small firms that successfully applied for a credit has risen substantially, but the average loan amount supplied remained largely constant. Moreover, very small firms did not step into multiple banking. By contrast, small firms widened their lender base and, on average, obtained slightly more credit. However, as a group, small firms considerably increased their share in the French banking sector's business portfolio, indicating that, as in the case of very small firms, some small firms that obtained a loan had been denied credit previously. Small firms that become better credit risk after having been considered intermediate credit risks do not necessarily increase their use of bank debt. This may indicate that for small and medium-sized enterprises with a good credit risk status, i.e. the large majority of firms (see Section 2), credit constraints are not binding. Medium-sized firms raised substantially more funds from banks, even at firm level, in 2000 than in 1993. Large firms in France suffer hardly from credit restrictions as their credit rating, the number and duration of their relationships with banks, and time dummies have very limited impact on the amount of approved bank loans (see Table A1 in the Annex).

#### **4. A new Basel Accord**

The final topic of this paper is the current proposal for a new capital adequacy accord (Basel II) and its possible implications for the availability of credit for SMEs. As noted in the introduction, the Basel Committee on Banking Supervision considers a new bank capital

adequacy framework. Contrary to current practice, where risk weights are determined only by the type of borrower irrespective of his specific credit risk profile, the new legislation allows computing risk weights as a function of individual credit risk, implying that riskier lending needs to be backed-up with more capital.

To calibrate the risk weight formulas of the Basel II proposal, the Committee uses a one-factor credit risk model, similar to the one presented in Box 2. The main purpose of this model is to determine risk weights as a function of individual risk characteristics of every borrower, in particular, its probability of default (PD) and the default correlations with borrowers in the same risk class. As shown in Section 2, PDs are higher for SMEs, but default correlations are lower in SME loan portfolios than in portfolios of loans to large firms. Many commentators of the first draft of the Basel II proposal (BIS 2001a) pointed out a calibration problem with the SME credit risk formulae. They argued that the risk-weight curve was too steep and too high for SMEs, resulting in excessive capital charges on SME loans.

*Due to diversification benefits it is justified to treat exposures on very small firms as retail lending.*

The second draft of the Basel II proposal (BIS 2002) took this criticism into account, considering two key modifications. One envisages different risk-weight formulae for SMEs and large businesses. Specifically, capital charges for loans to very small firms may be computed on the basis of the retail risk-weight function, which assumes lower default correlations and, therefore, implies lower risk weights and capital charges. The second modification concerns the use of risk-weight formulae that assume a negative relation between PDs and default correlations, i.e. default correlations are posited to be low for high PDs, and vice versa. The result is a risk-weight curve that is generally lower for SMEs than for large firms, producing lower capital charges on SME exposures. Default correlations are thus a key element of Basel II. Overall, compared to the first draft of the Basel II proposal, both modifications would reduce capital requirements for SMEs.

What can be said about the wisdom of these possible modifications? The first one seems to make eminent sense. Even if very small firms are riskier on an individual basis than larger firms, the positive effect of diversification when loans to these firms are integrated into a sizeable loan portfolio justifies treating them as retail lending.

We are far more sceptical about the second modification, however. From an economic viewpoint, a negative relation between PDs and default correlations means that, irrespective of the business cycle, less risky borrowers are more exposed to systematic risk (or to the cycle) than the riskier ones; it also means that for riskier borrowers, the idiosyncratic risk prevails. In Section 2, we did not find a negative relation between PDs and default correlations for our sample of French SMEs<sup>9</sup>. But we found for SMEs that default correlations decrease with firm size. So, larger SMEs should probably receive a more favourable treatment than smaller ones because the former are less sensitive to systematic risk than the latter and, in addition, larger SMEs have lower PDs than smaller ones. Overall, from a capital adequacy viewpoint, the second modification would treat larger French SMEs unfairly compared to smaller SMEs. Having said this, the second modification works better in terms of accounting for differences between SMEs and large firms; this is because PDs are higher and default correlations are lower for SMEs than they are for large firms. But our overall conclusion is that a one-size-fits-all solution is not appropriate, mainly because it penalises medium-sized enterprises relative to small firms.

<sup>9</sup> Dietsch and Petey (2003) find no evidence for a negative relation in a large sample of German SMEs.

But apart from an insufficient distinction between SMEs of different sizes, there are some broader implications for the capital requirements envisaged for lending to the SME sector. We have shown that estimated default correlations in the SME population are very low (0.013 on average). In light of this, the second draft proposal of Basel II does perhaps not go far enough in reducing the capital charge on SME loan portfolios. To substantiate this view, we have computed the capital charges on a very large portfolio, including loans of more than 250,000 French SMEs, under different capital adequacy regimes. In calculating capital charges, we adopted two broad approaches - or capital adequacy regimes - both following the internal-ratings-based (IRB) approach envisaged as one possible option under Basel II.<sup>10</sup> The first approach is the current Basel II proposal, which distinguishes loans falling into the retail category from loans not qualifying for this category (see Box 3). The second approach is based on the portfolio model that uses risk-weight formulae (see Box 3) based on PDs and default correlations derived in Section 2; we considered two variants of the portfolio model: one is based on a normal distribution (the probit model) while the other rests on a gamma distribution.

Table 11 shows the results of our calculations and also presents the required capital adequacy ratio under current legislation, i.e. the 1988 Basel Accord. The following points are worth highlighting. First, there are large differences between the currently required capital ratio and the two ratios based on the current Basel II proposal. For loans to medium-sized French firms in the non-retail category, the capital charge would fall from 8 to 5 percent if the current Basel II proposal is implemented. The capital relief is even stronger (falling to less than 4 percent) for credits to firms that qualify as retail loan. Therefore, Basel II has the potential to considerably boost the credit availability for SMEs in France! However, we note that European banks in general keep their own funds well above the required minimum set by the regulator.

*Basel II is likely to provide capital relief on SME loans outstanding at French credit institutions.*

Second, there are substantial differences between the capital charges under the current Basel II proposal and the capital charges calculated with our portfolio credit risk model, which suggests that the underlying SME portfolio risk would not require a capital adequacy ratio in excess of 2 percent. In light of this, the current Basel II proposal continues to be overly conservative.

Obviously, these striking results are explained by the large differences between the effective values of the default correlations in the SME sample (0.013) and the values

**Table 11. Capital charges (in % of loan volume) on a French SME loan portfolio under different capital adequacy approaches**

1988 Basel Accord	Basel II			
	Current proposal		Portfolio model of Box 2	
	"Non-retail"	"Retail"	Normal distribution	Gamma distribution
7.9	5.0	3.9	1.4	1.7

Notes: The total volume of the portfolio is equal to EUR 63 billion and includes loans to more than 250,000 SMEs; in the Gamma model,  $\sigma^2=2$ .

<sup>10</sup> Basel II also provides for a "standardised approach" for assets that are rated by external rating agencies.

### Box 3. BIS risk weight formulae in Basel II

The last version of the Basel II proposal (BIS, October 2002), the default correlations  $R$  are defined by the following equations:

#### Non-retail exposures

$$(1) R = 0.12 \times (1 - \exp(-50 \times PD)) / (1 - \exp(-50)) + 0.24 \times [1 - (1 - \exp(-50 \times PD)) / (1 - \exp(-50))]$$

#### Retail exposures

$$(2) R = 0.02 \times (1 - \exp(-35 \times PD)) / (1 - \exp(-35)) + 0.17 \times [1 - (1 - \exp(-35 \times PD)) / (1 - \exp(-35))]$$

where  $PD$  is the borrower's probability of default. These formulae give a negative relationship between  $R$  and  $PD$ . For exposures below EUR 1 million, the retail formula (2) is applied. This gives a value of  $R$  between 0.02 and 0.17. Exposures above EUR 1 million are assigned to the corporate segment. However, those businesses with a turnover lower than EUR 50 million (but above EUR 5 million) get a specific treatment: the correlation as computed with (1) is reduced by:

$$(3) 0.04 \times \left(1 - \frac{S - 5}{45}\right)$$

where  $S$  is the borrower's turnover. This correction takes 4 percent off of the computed correlation in (1) for firms with a EUR 50 million turnover. No correction is made for firms with a turnover between EUR 1 and 5 million. All in all, the default correlation for this class of medium-sized businesses varies between 0.08 and 0.2.

Finally, risk weights are computed as follows:

#### Non-retail exposures

$$(4) K = LGD \times \Phi \left[ (1-R)^{-0.5} \times \Phi^{-1}(PD) + (R/(1-R)) \times \Phi^{-1}(0.999) \right] \times \frac{1 + (M - 2.5) \times b(PD)}{1 - 1.5 \times b(PD)}$$

#### Retail exposures

$$(5) K = LGD \times \Phi \left[ (1-R)^{-0.5} \times \Phi^{-1}(PD) + (R/(1-R))^{0.5} \times \Phi^{-1}(0.999) \right]$$

where  $LGD$  is the loss given default (following the IRB approach, we assumed a fixed recovery rate of 50 percent),  $\Phi$  is the normal cumulative distribution function,  $M$  is the effective remaining maturity, and  $b(PD)$  is a maturity adjustment (the assumed maturity is 3 years) :

$$b(PD) = (0.08451 - 0.05898 \times \log(PD))^2$$

We note that the granularity condition is largely verified due to the large size of the portfolio.

implicit in the Basel II formulae (between 0.02 and 0.17 for retail exposures, between 0.08 and 0.2 for medium-sized exposures, see Box 3) and the relatively low average level of default risk in the French SME population (see Table 4). Therefore, one needs to be cautious when drawing conclusions from Table 11. Indeed, actual past correlations could be poor estimates of future correlations, as pointed out in Section 2. One reason is that our data covers only a fairly short period of time when the economy was doing well. Another reason mentioned before is that the experiment summarised in Table 11 is not



based on actual bank loan portfolios, but on a larger sample of French SMEs. However, additional simulation exercises on smaller portfolios, created by drawing 5,000 firms randomly from the full sample, reveal a positive relationship between PDs and default correlations, which stands in sharp contrast with the current Basel II proposal.

To conclude, it is misplaced to believe that the implementation of a new Basel Accord will harm bank lending to SMEs in France. Our finding suggests that Basel II will promote credit availability since capital charges on SME loan portfolios are likely to fall considerably. This is mainly the result of low default probabilities and the positive effect of diversification in large SME portfolios. We advocate a possible further reduction of the SME risk weights in the current proposal since we find a very weak sensitivity of SMEs to systematic risk. In addition, we strongly argue against assuming a negative relationship between PDs and default correlations. The data does not support such a relationship, and erroneously using it would result in too high capital charges for the less risky medium-sized enterprises in comparison to smaller firms and, as a result, less risky firms would cross-subsidise riskier firms.

As an aside, the analysis of this paper demonstrates the usefulness of portfolio credit risk models for financial institutions. In particular, credit risk management and the allocation of loans and, ultimately, the economy in general should benefit from the introduction of such a tool.

## 5. Conclusion

There has been widespread concern that recent and future developments in European banking markets are detrimental to bank lending to small and medium-sized enterprises. Bank consolidation has been deemed to have negative effects on small businesses since large banks tend to focus on large companies. Some observers also warned that the implementation of a new Basel Accord would harm SME financing since many small businesses are not rated by external credit rating agencies and could therefore not apply for lower risk weights. In this paper, we have presented strong empirical evidence that clearly rejects these two hypotheses. In contrast with these two predictions, we find that bank consolidation in France has improved credit availability for SMEs and if banks adopt the Internal Rating Based approach of Basel II, it is likely that French SMEs will have even better access to bank credit in the future.

During the second half of the 1990s, French banking industry consolidation was accompanied by an increase in multiple banking. We find a strong positive relationship between credit availability and the number of creditors and the duration of bank-firm relationships. Moreover, the smaller the firm is, the greater is the impact of increasing the number of lenders and the duration of relationships. With the exception of very small firms, small and medium-sized enterprises have increased the number of banks they borrow from during the consolidation wave. As a consequence, these companies were able to obtain more bank credit. Very small firms did not increase the number of banks they borrow from, probably because they perceive it as too costly; interestingly enough, our econometric results suggest that the very small firms would profit most from multiple banking. This could be an indication that very small firms in France still face credit constraints. However, finance constraints seem to weaken even for this size class, which

*The transformation of the French banking industry allow SMEs to access bank credit more easily.*

includes many information-opaque customers. Indeed, very small firms substantially increased their share in the total business loan portfolio. Small firms did the same. These changes in the composition of the business loan portfolio came at the expense of large enterprises. It is worthwhile mentioning that the average very small firm and the average small firm did not obtain a substantially bigger loan. But many of these firms that received a bank loan at the end of the 1990s did not obtain any credit in the early 1990s.

Our model of credit availability also shows that an upgrade in the (Coface) credit risk rating improves the credit availability for very small firms, irrespective of their initial rating. However, small and medium-sized firms with intermediate credit risk grades do not substantially increase their use of bank loans when their credit status improves. This suggests that credit constraints are not binding for the majority of small and medium-sized firms in France given that they have a relatively low credit risk profile. In sum, we find that only very small firms, i.e. firms with an annual turnover below EUR 2 million, and firms with high credit risk may have difficulties in accessing bank credit, but credit rationing is not a widespread phenomenon in the market for loans to French SMEs.

To measure the possible effects of the latest Basel II proposal on SME credit availability, we have developed a one-risk factor credit risk model. Credit risk decreases significantly with size. This can partly explain the difficulty of accessing credit for some of the smaller firms, especially when the duration of the bank-firm relationship is short. However, default correlations are lower for SMEs than for large firms. This suggests that, in contrast with conventional wisdom, small and medium-sized enterprises are less sensitive to the business cycle than large companies. A portfolio of SME loans is therefore not necessarily riskier than a portfolio of loans to large firms. Furthermore, we showed that the sensitivity of SMEs to macroeconomic risk does not appear to be as high as assumed in the current Basel II proposal. Although the current Basel II proposal gives considerable scope to improve SME credit availability in the future, our evidence supports even lower risk weights, especially for medium-sized companies, which - if applied - could further stimulate SME lending.

*Basel II is still overly conservative with regard to banks' exposures to SMEs.*

## Annex

### An econometric model of SME credit availability

The main purpose of our econometric model of credit availability is to test whether there is a positive effect on the loan amount obtained by a firm in a given year of (i) an increase in multiple banking, (ii) an increase in the length of the bank-firm relationship, (iii) a reduction of credit risk, and (iv) an increase in the size of the lending bank's loan portfolio while controlling for other variables such as company size, year, and a dummy indicating whether or not the lending bank is the borrower's main (house) bank.

The dependent variable of our model is the ratio of the loan amount obtained from a single bank in a given year to the firm's turnover. Note that firms can borrow from several banks in a given year, so that a firm enters the database more than once in that year. Explanatory variables are: (i) the number of banks a firm borrows from, (ii) the length of the lending bank-firm relationship, (iii) the Coface credit rating of the borrower, (iv) the size of the loan portfolio of the lending bank, and (v) control variables:

$$(1) \quad LOAN_{b,it} = \alpha + \beta DSIZE_{it} + \kappa PORTFOLIOSIZE_{b,it} + \varphi DRISK_{it} + \theta MAINBANK_{b,it} + \delta DNBBANK_{it} + \gamma DLENGTH_{it} + \eta DYEAR + \varepsilon_{it}$$

where

$LOAN_{b,it}$  is the annual amount of loans firm  $i$  obtained from creditor  $b$  in year  $t$ , divided (normalised) by the firm's turnover of that year;

$DSIZE$  is a vector of size dummies (when the model is estimated by size class, these dummies were obviously omitted and replaced by the logarithm of the firm's turnover as an indicator of the borrower's size inside each size class);

$PORTFOLIOSIZE_{b,it}$  measures the size (in terms of the number of different borrowers) of the business loan portfolio of the lending bank  $b$  of firm  $i$  in year  $t$ ;

$DRISK$  is a vector of dummies corresponding to the firm's Coface credit rating;

$MAINBANK_{b,it}$  is a dummy taking the value one if bank  $b$ , which supplies a credit in period  $t$  to firm  $i$ , is the main bank of firm  $i$  (here the main bank is defined as the most important lender of the firm), and zero otherwise;

$DNBBANK$  is a vector of dummies measuring the borrower's number of banks;

$DLENGTH$  is a vector of dummies measuring the length of the bank relationship with the main bank;

$DYEAR$  is a vector of time dummies and  $\varepsilon_{it}$  is the error term.

The model is estimated with OLS. In the regression analysis, the following dummies are omitted and, consequently, serve as reference points: the size 1 (very small firms) dummy, the rating class 8 (highest risk) dummy, the single bank dummy, the one-year-length of bank-firm relationship dummy, and the 2001 dummy.

**Table A1. OLS parameter estimates of the SME credit availability model**

Variables	Size (turnover in EUR million)				
	All firms	Very small (# ≤ 2)	Small (2 < # ≤ 7.5)	Medium-sized (7.5 < # ≤ 40)	Large (# > 40)
Intercept	20.0	583.1	106.5	18.6	19.0
Small	-27.5				
Medium-sized	-32.9				
Large	-36.5				
Log turnover		-42.5	-6.9	-1.2	-1.2
Portfolio size	-0.1	0.1	0.0	-0.1	-0.1
Risk class 1	6.5	35.0	4.9	0.7	1.3
Risk class 2	2.0	6.5	-1.8	-0.4*	0.8*
Risk class 3	3.0	7.6	-1.2	0.3*	1.5*
Risk class 4	5.0	8.8	-0.3*	1.4	1.6*
Risk class 5	4.2	7.2	-0.3*	1.7	1.6*
Risk class 6	16.6	19.3	6.6	5.3	4.0
Risk class 7	6.9	7.9	2.1	2.5	1.4*
Main bank dummy	10.1	11.5	7.7	8.6	8.4
Number of banks: 2	6.5	22.7	4.0	3.8	2.9
Number of banks: 3	8.3	36.4	6.3	4.4	3.6
Number of banks: 4	8.6	40.5	8.6	4.6	3.9
Number of banks: 5	8.8	47.7	10.0	5.2	4.2
Number of banks: 6	8.9	46.5	12.3	5.8	4.3
Number of banks: 7	10.3	54.7	12.7	10.0	6.7
Length 2	4.8	10.2	1.3	0.9	0.0*
Length 3	5.0	12.6	1.8	0.7	0.1*
Length 4	7.2	20.3	3.0	1.5	0.9
Length 5	13.7	40.2	7.9	5.5	3.1
Year 1994	0.7	5.6	0.2	-0.1*	-0.7
Year 1995	-2.6	-3.2	-1.8	-1.1	-1.1
Year 1996	-3.3	-4.8	-2.1	-1.6	-1.3
Year 1997	-2.4	-3.2	-1.4	-1.1	-0.8
Year 1998	-3.7	-6.5	-1.9	-1.1	-0.8
Year 1999	-2.9	-5.2	-1.2	-0.8	-0.7
Year 2000	-0.9	-1.4	-0.4	-0.4	-0.4
Number of Observations	2,530,353	752,235	833,531	660,646	283,941

Notes: \* non-significant at the 5 % confidence level.

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