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**A Credit Crunch? A Case Study of Finland in the Aftermath of the Banking Crisis**

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### Abstract

This paper estimates a disequilibrium model of credit supply and demand to evaluate whether there was a credit crunch in Finland following the banking crisis of 1991-92. Empirical analysis suggests that the marked reduction in bank lending was mainly in reaction to a cyclical decline in credit demand, likely exacerbated by the high level of indebtedness of the borrowers. It also appears that banks became less willing to supply credit during periods associated with a deterioration in asset quality, and reduced profits due to declining regulatory protection from competition, and a need to increase capital adequacy levels.

**JEL Classification Numbers:**

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## **A Credit Crunch? A Case Study of Finland in the Aftermath of the Banking Crisis**

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## SUMMARY

The Finnish banking industry underwent considerable change in the second half of the 1980s, a period marked by increased competition in financial services, economic deregulation, the removal of cross-border restrictions on capital flows, and financial innovation. After a sharp credit boom, it also proved to be a period leading to financial fragility, as lower asset quality and declining profitability eroded banks' balance sheets to the point where the Government in the early 1990s had to support some of the largest banks to preserve financial stability. Banks' income from financial operations declined owing to the loss of interest payments on non-performing assets and growing loan losses. Subsequently loans to the private sector declined significantly, leading to concern that the condition of the banks had brought about a credit crunch. In order to evaluate whether there was a credit crunch in the aftermath of the banking crisis in Finland, this paper estimates a disequilibrium model of a system of equations for the supply of and demand for business credit using monthly data on financial sector indicators.

The results of the disequilibrium analysis for business credit suggest that the marked reduction in bank lending during the 1990s has been mainly in reaction to a cyclical decline in credit demand, reflecting partly the high level of indebtedness of the borrowers. It also appears that banks have become less willing to supply credit during periods associated with a deterioration in asset quality, erosion of rents accruing to banks because of declining regulatory protection from competition, as well as a need to increase capital adequacy levels. The episodes of a reduction of supply relative to demand, such as in 1994, have been accompanied by a rise in the spread between the bank lending rate and the marginal cost of bank funding.



A credit crunch occurs when the supply of credit is restricted below the range usually identified with prevailing market interest rates and the profitability of investment projects.  
The Council of Economic Advisors (1992)

## I. INTRODUCTION

The purpose of this paper is to evaluate whether there has been a credit crunch in Finland in the aftermath of the banking crisis of 1992-93. As background, the Finnish banking industry underwent considerable changes in the second half of the 1980s. The period was marked by increased competition in financial services, economic deregulation, the removal of cross-border restrictions on capital flows, and financial innovation. After a sharp credit boom, it also proved to be a period leading to financial fragility, as lower asset quality and declining profitability eroded banks' balance sheets to the point where the Government in the early 1990s had to support some of the largest banks to preserve financial stability. As a result of problem assets, banks' income from financial operations declined due to the loss of interest payments on nonperforming assets and growing loan losses. Subsequently loans to the private sector declined significantly leading to concerns that the conditions of the banks had brought about a credit crunch.

A credit crunch is generally defined as a decline in the supply of credit resulting from a reduced willingness to lend by banks that is not reflected in higher lending rates. Most factors that limit credit supply by banks also affect alternative sources of financing. However, there are certain factors which are unique to banks, such as increased regulatory oversight and banks' own reaction to deterioration of bank asset values and profitability. In this framework, credit crunch results from rational profit maximizing behavior of lenders under asymmetric information. More specifically, banks may not be willing to increase the interest rate enough to eliminate excess demand if the adverse selection and incentive effects of such an increase lead to decreasing expected profits.

Understanding whether weak business credit growth is related to a credit crunch or to weak demand for credit is important from a policy perspective. If the supply of credit or the willingness to lend plays an important role, then structural measures (e.g., regulatory changes and intervention to strengthen the banking system) may be needed to remove the obstacles to growth. With this in mind, a disequilibrium model of credit supply and demand is estimated in an attempt to identify the factors determining business credit. The results of the empirical analysis suggest that even though there may be some evidence of a credit crunch immediately after the banking crisis, since 1993 the reduction in bank lending has been mainly in reaction to a decline in credit demand, rather than to a credit crunch.

The rest of the paper is organized as follows. Section II provides a review of the relevant empirical literature. Sections III and IV outline the model and the estimation methodology, respectively. Section V presents the empirical results. Concluding remarks are provided in section VI. The Appendix provides data sources.

## II. LITERATURE REVIEW

The flow of credit results from factors which affect both the supply and demand for credit. In other words, there is an identification problem: the observed decline in the volume of credit may be the result of a decline in willingness to lend or a weak demand for loans. <sup>1/</sup> In the relevant empirical work on this topic, disequilibrium econometric models have been used to establish the empirical significance of a credit crunch. The results of Laffont and Garcia (1977) for Canada, Sealy (1979) for the United States, Ito and Ueda (1981) for Japan and Kugler (1987) for West Germany and Switzerland indicate large disequilibrium situations in the market for bank loans. In contrast, the empirical results do not show any evidence of disequilibrium for the United States in Ito and Ueda (1981), for the United States and United Kingdom in Kugler (1987) and for Australia in Blundell-Wignall and Gizycki (1994). Using state-by state data for the U.S. Bernanke and Lown (1991) conclude that bank capital limited banks' credit supply thus supporting the "credit crunch" hypothesis".

Following the approach of Bernanke and Lown (1991), Soltila and Vihriälä (1992) find a very small but statistically significant negative relationship between the growth of lending by individual Finnish savings banks in 1991 and their projected capital adequacy indicator. However, as reported by Vihriälä (1996a) the analysis suffers from a very inadequate treatment of demand factors, and there is no attempt to account for differences in borrower quality.

In a recent study, Saarenheimo (1995) analyzes the linkages between the recent collapse in investment and the decline in bank credit in Finland. The main question he addresses is whether the decline in bank credit and investment merely reflects the fall in the demand for credit or whether the slump in investment is due to the tightening of bank credit and firms' inability to raise external funds. He finds some evidence that the latter may be the case in Finland. His first argument is that the margin between the loan rate linked to the interbank rate and the three-month interbank rate shows an upward shift around 1990. He notes that the fact that there has not been any reduction in interest margins seems to imply that the weak demand for loans alone does not explain the sluggishness in the credit market. Saarenheimo's second argument is that the commercial paper issued by firms continued to grow for several years after the decline in bank loans. This implies that firms may have substituted this alternative source of funds in response to a decline in access to bank credit. He also reports that according to surveys and various informal sources, small and medium-sized firms have faced problems in obtaining bank loans because of insufficient collateral.

Using a switching regression model Vesala (1995) simultaneously estimates the demand and supply relations characterizing the banking industry equilibrium. He finds that reversions in competitive conduct of the Finnish deposit banks have occurred during 1987:4-1993:11 and that price competition in the loan market was exceptionally tight during the latter

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<sup>1/</sup> See Bhattacharya and Thakor (1993) and Vihriälä (1996a) for a survey of the theoretical literature on credit rationing.

half of 1989. He also reports that during 1993 the banks' lending margins appear to have been higher than earlier implying that the banks have tried to recoup some of their credit losses by increasing lending margins.

Vihriälä (1996a) reports that credit crunch due to banks' capital shortages, bank managers' risk aversion, and regulatory tightening have been blamed in public discussion for the sharp recession and the slow recovery experienced in Finland. Based on aggregate data, he concludes that the tightening of capital regulations, the substantial depletion of bank capital, and changed risk attitudes and disturbances caused by restructuring are possible explanations of conservative lending by banks. Thus, the results appear to confirm the existence of a credit crunch due to bank capital problems in 1991-92.

In another study, Vihriälä (1996b) analyzes bank lending in the early 1990s for 393 savings and cooperative banks and concludes that the findings do not support the hypothesis of a general credit crunch caused by inadequacy of capital. Moreover, some banks, especially cooperative banks, with potentially weak capital base appear to have accelerated their credit expansion ("gamble for resurrection"). Vihriälä also notes, however, that weak borrower quality contributed to the contraction of bank lending in 1991-92.

### III. THE MODEL

In order to evaluate whether there was a credit crunch in the aftermath of the banking crisis in Finland, this paper estimates a disequilibrium model of a system of equations for the supply of and demand for business credit. Following the work by Laffont and Garcia (1977) and Blundell-Wignall and Gizycki (1994), the supply and demand for business credit is modeled as follows (see Appendix for a discussion of the data).

#### 1. The credit supply equation

The supply of business loans ( $L^s$ ) is determined by a portfolio management approach. In this framework, given expectations on yields of different assets, the bank takes into account the available resources in deciding on the amount of business credit to supply. In the specification of the loan supply function used in this paper, the available resources are represented by total deposits and the book value of capital ( $D$ ). In addition, the stock market's assessment of the relative expected profitability of banks is included in order to determine the ease with which banks can raise new capital to fund loans in the following period. The banking sector share price relative to the market average ( $sp_v/sp$ ) is used as a proxy for the stock market's assessment. Both  $D$  and ( $sp_v/sp$ ) increase the resources available to the bank and are expected to have a positive effect on the supply of loans.

The rate on short-term bank loans ( $i_1$ ) is used to denote the profitability of banks' lending activities. This variable is expected to have a positive effect on the supply of business credit.

The market capitalization of corporate equity ( $E_{corp}$ ) is used to represent the net worth of the corporate sector and the collateral available to banks, and is expected to have a positive sign.

To account for a cyclical risk premium, the difference between the lending rate and the money market rate is used ( $i_t - i_{mm}$ ). The higher the loan rate relative to the money market rate, the higher are the cyclical agency costs and thus the higher is the risk premium. As in Bernanke and Gertler (1989), it is assumed that agency costs decline in booms and rise in recessions. These include costs associated with adverse selection and moral hazard which arise due to asymmetric information between borrowers and lenders.

Two alternative proxies are used to represent the state of the overall economic environment. First, the expected inflation rate ( $\pi^e$ ) is predicted to have a negative effect on the credit supply of banks. As high inflation is likely to be associated with greater uncertainty banks are expected to be more cautious in lending in a high inflation environment. The second variable is the expected industrial production ( $y^e$ ), formulated with a distributed lag, which is expected to have a positive sign.

As in Blundell-Wignall and Gizycki (1994), the variance of bank share prices ( $\sigma$ ) relative to the market average is included as a variable reflecting risks specific to the banking sector. A higher  $\sigma$ , i.e. higher banking risks are expected to lead to a decline in the supply of business credit by banks.

Thus, the following specification for the credit supply equation was used for estimation purposes:

$$\Delta L_t^s = \alpha_0 + \alpha_1 \Delta D_{t-1} + \alpha_2 \left(\frac{sp_b}{sp}\right)_{t-1} + \alpha_3 i_{t,t} + \alpha_4 E_{t-1}^{corp} - \alpha_5 (i_t - i_{mm})_t - \alpha_6 \pi_t^e + \alpha_7 y_t^e - \alpha_8 \sigma_t \quad (1)$$

## 2. The credit demand equation

As discussed in Laffont and Garcia (1977), it is important not to impose rationing on demand by including explanatory variables which would reflect an eventual rationing such as the volume of actual investment. To avoid this problem, the volume of expected fixed investment is used as an explanatory variable. <sup>1/</sup> However, it could be argued that bank customers take into

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<sup>1/</sup> Another potential problem in using data on investment is that loan demand is a stock variable whereas investment is a flow variable.

account that there may be rationing when making future investment plans. This variable, ( $I^e$ ), is expected to have a positive effect on the demand for business credit.

The demand for business credit ( $L^d$ ) is expected to depend negatively on the lending rate ( $i_t$ ), as bank customers would delay investment plans during periods in which the lending rates for a given rate of expected inflation are higher. As higher level of inflation would erode the value of nominal debt, the demand for credit depends positively on the expected rate of inflation ( $\pi^e$ ). Similar to the effect on credit supply, expected growth proxied by the distributed lag on the index of industrial production,  $y^e$ , is expected to have a positive effect on demand for credit.

Therefore, the following specification for the credit demand equation was used for estimation purposes:

$$\Delta L_t^d = \beta_0 - \beta_1 i_{t,t} + \beta_2 I_t^e + \beta_3 \pi_t^e + \beta_4 y_t^e \quad (2)$$

#### IV. EMPIRICAL METHODOLOGY

Simplifying equations (1) and (2), the model considered in this paper consists of the following equations:

$$L_t^s = X_{1t}' \alpha + u_{1t} \quad (3)$$

$$L_t^d = X_{2t}' \beta + u_{2t} \quad (4)$$

where  $L^s$  denotes quantity of net business credit supplied,  $L^d$  quantity of net business credit demanded,  $X_{1t}$  and  $X_{2t}$  denote variables that influence supply and demand respectively, and  $u_{1t}$  and  $u_{2t}$  are the residuals.

Allowing for the possibility that the price of credit is not perfectly flexible and rationing occurs, the disequilibrium hypothesis is formulated as follows:

$$L_t = \min (L_t^s, L_t^d) \quad (5)$$

where  $L_t$  is the actual quantity of business credit observed during period  $t$ . As shown by Maddala and Nelson (1974), in the absence of any information concerning the price adjustment process and assuming that the errors are normally distributed random variables, the model itself allows the determination of the probabilities with which each observation belongs to the demand or supply equation. Maddala and Nelson discuss the appropriate maximum

likelihood method for this class of models which resembles the method suggested by Tobin (1958) for the estimation of models with limited dependent variables. The log likelihood function (ML) is defined as follows:

$$ML = \sum_{t=1}^n \log [ f_1(L_t) * F_2(L_t) + f_2(L_t) * F_1(L_t) ] \quad (6)$$

where,

$$\begin{aligned} f_1(L_t) &= \frac{1}{\sqrt{2\pi}\sigma_1} \exp \left[ -\frac{1}{2\sigma_1^2} (L_t - \alpha X_{1t})^2 \right] , \\ f_2(L_t) &= \frac{1}{\sqrt{2\pi}\sigma_2} \exp \left[ -\frac{1}{2\sigma_2^2} (L_t - \beta X_{2t})^2 \right] , \\ F_1(L_t) &= \frac{1}{\sqrt{2\pi}\sigma_1} \int_{L_t}^{\infty} \exp \left[ -\frac{1}{2\sigma_1^2} (L_t^s - \alpha X_{1t})^2 \right] dL_t^s , \\ F_2(L_t) &= \frac{1}{\sqrt{2\pi}\sigma_2} \int_{L_t}^{\infty} \exp \left[ -\frac{1}{2\sigma_2^2} (L_t^d - \beta X_{2t})^2 \right] dL_t^d . \end{aligned} \quad (7)$$

Using the Newton-Raphson iterative procedure, the log likelihood function shown in equation (6) is used to obtain the maximum likelihood estimates based on monthly data from 1981 to 1995.

## V. ESTIMATION RESULTS

The estimation results are shown in Table 1. As the Finnish banking sector was fully liberalized in August 1986, equations (1) and (2) are estimated for the years 1987-95, the period after the liberalization. 1/

In the loan supply equation, the lending rate has the expected positive sign for both specifications; the effect of this variable is stronger in the post-deregulation period. Deposits have the expected positive signs for the pre-deregulation period, while they are insignificant for the post-deregulation period. This reflects the fact that deposits were the main instrument in bank funding prior to deregulation while after deregulation money market debt and foreign currency debt has been widely used. The relative share price index, proxying for the ease with which banks can raise new capital, has the expected positive sign in both specifications and as would be expected the effect of this variable is stronger in the period after the deregulation.

The market capitalization of corporate equity, proxy for the collateral available to banks, enters the equations with the expected positive sign with a higher coefficient in the post-deregulation period. The equations were also estimated for the sub-period 1991-95. The results are comparable to the post-deregulation results; most variables have similar coefficients except the coefficient of the market capitalization variable becomes stronger suggesting that the banks paid more attention to borrower quality in the aftermath of the banking crisis. 2/

The effects on loan supply of the proxies for the state of the economy, expected inflation and output, are only significant for the post-deregulation period. The risks specific to the banking sector, represented by the variance of bank share prices relative to the market average, does not appear to have an important explanatory power.

The difference between the lending rate and the money market rate, a proxy used to represent cyclical agency costs, has the expected negative sign for the post-deregulation period. However, the interest rate differential receives a highly significant positive coefficient in the pre-deregulation period. A plausible explanation for this puzzling result may be that in the pre-deregulation period the interest differential did not in fact reflect credit risk but rather profitability of lending. In the pre-deregulation period, banks' credit losses were insignificant and credit risk did not figure in a major way in lending decisions. Furthermore, due to interest

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1/ Chow tests were performed to test for the stability of regression coefficients over the sample period. A structural break was identified between 1986-87, the period of financial deregulation.

2/ The author would like to thank Vesa Vihriälä for useful discussions on this issue.

Table 1. Finland: Estimation Results

	PRE-DEREGULATION PERIOD		POST-DEREGULATION PERIOD	
	(1)		(2)	
	$\Delta L^S$	$\Delta L^D$	$\Delta L^S$	$\Delta L^D$
<b>Constant</b>	-17.21** (-2.56)	-11.94** (-6.48)	-50.88** (-15.89)	-8.32 (-0.75)
<b>Lending Rate</b>	2.76** (4.69)	-3.49** (-2.29)	7.36** (2.47)	-4.68** (-3.14)
<b>Deposit</b>	4.20** (17.34)		0.02 (1.46)	
<b>Market Capitalization</b>	0.04** (3.27)		0.07** (4.97)	
<b>Inflation</b>	0.21 (0.50)	-4.72 (-0.40)	-6.89* (-1.61)	-5.80** (-2.18)
<b>Relative Share Price Index</b>	4.77** (5.71)		9.02** (1.98)	
<b>Variance of Share Price Index</b>	0.05 (0.88)		0.04 (0.16)	
<b>Interest Differential</b>	2.92** (15.83)		-2.68** (-2.09)	
<b>Output</b>	0.71 (0.33)	0.56 (1.05)	2.96** (2.92)	11.33 (0.97)
<b>Expected Investment</b>		0.01** (2.88)		0.02** (1.70)
<b>Number of Observations</b>	81		111	
<b>Log Likelihood Function</b>	-158.04		-408.16	

1/ The asterisks, \*\* and \*, denote significance at 95% and 90% confidence intervals, respectively. T-statistics are provided in parentheses.

rate regulation, banks could not apply credit risk premia in lending. The change in the coefficient in the post-deregulation period may imply that following the deregulation credit risks were taken into account in lending decisions. This is consistent with the hypothesis that borrower quality was a major factor behind the decline in credit stock in the 1990s.

Important determinants of the loan demand equation are lending rate and expected investment and both have the expected signs. Output does not appear to have a significant explanatory power in the loan demand equation for either of the subperiods. Inflation has a negative effect on loan demand in the post-deregulation period.

Based on the estimates obtained for the demand and supply of business credit in the post-deregulation period, the percentage by which demand exceeds supply is calculated and presented in Chart 1. The excess demand for business credit prevails even after the deregulation of financial markets (1986-88) which reflects the fact that the banks remained constrained with respect to their lending rates. Finnish bank loans traditionally carried variable interest rates and all loan rates were tied to the base rate, which was set administratively by the Bank of Finland and tended to be relatively unresponsive to changes in market conditions. <sup>1/</sup> Also, the indebtedness of the corporate sector grew rapidly as corporations had been highly dependent on borrowing from financial institutions and, as in other countries with universal banking systems, relied heavily on debt financing.

Reflecting institutional changes as well as increased access to credit by borrowers, the period 1989-91 which is also a period of strong credit expansion, is characterized by alternating periods of excess supply and excess demand. In particular, in January 1990, the Bank of Finland allowed banks to set their own prime interest rates in borrowing and lending.

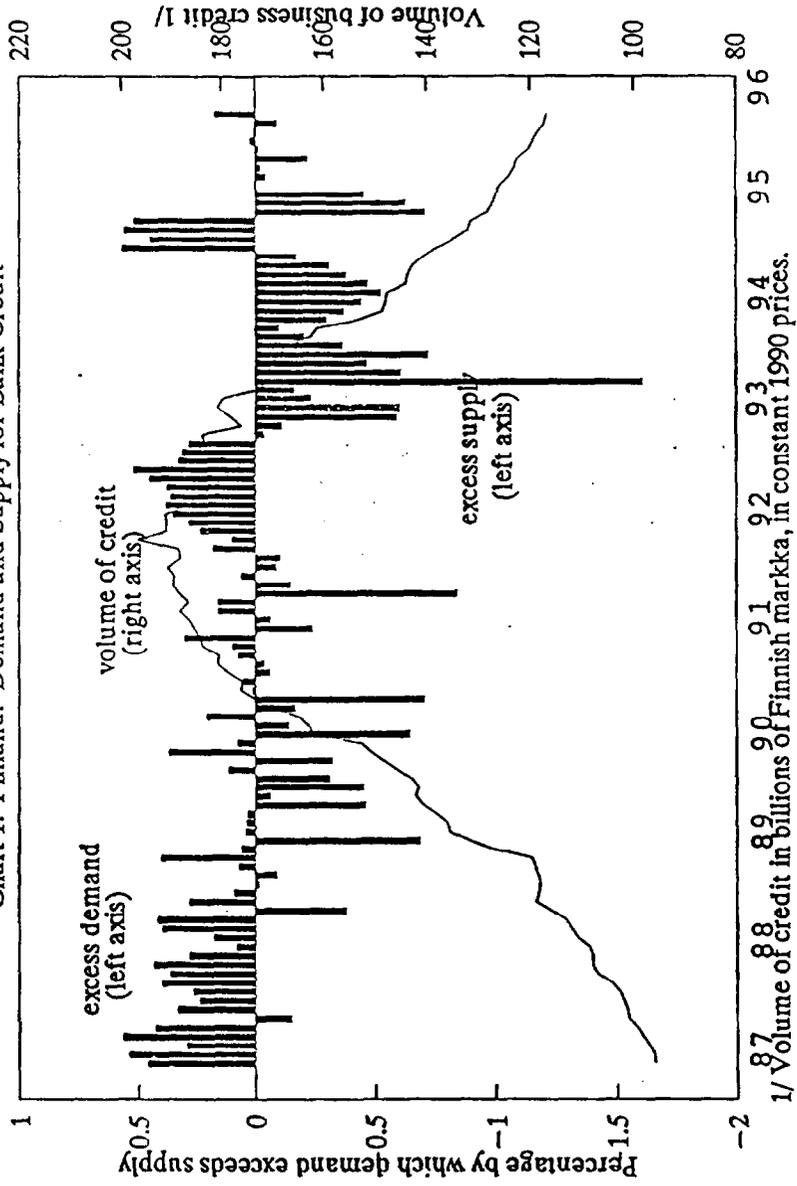
Furthermore, banks were allowed to emit their own certificates of deposit. The development of money markets--besides changing the conduct of monetary policy--provided banks with new funding opportunities, permitting more aggressive lending largely financed by bought funds instead of standard retail deposits. Similarly, the lifting of foreign exchange restrictions allowed banks to acquire funds abroad and to lend them as foreign-currency denominated loans to domestic customers.

It is interesting to note that in the crisis period (mid-1991 to 1993) the market for *business credit changed from a mainly supply determined market to a demand determined market*. This is consistent with the findings of Vihriälä (1996a, 1996c).

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<sup>1/</sup> See Drees and Pazarbaşıoğlu (1995).

Chart 1. Finland: Demand and Supply for Bank Credit



In contrast, the period between 1993 and mid-1994 is characterized by weak demand for credit, perhaps reflecting the balance sheet consolidation efforts of borrowers and the tightened collateral requirements. The turnaround in domestic demand, which was particularly brisk in the first few months of 1994, as reflected in the sharp increase in the sales of consumer durable goods, seems to have led to the excess demand for capital during late 1994. During this period, increases in corporate sector's profitability, reduced indebtedness of the sector and lower interest rates contributed to a 22 percent rise in machinery and equipment investment. Since then there is no further evidence of credit rationing.

The model predicts more or less an equilibrium situation in the credit market for the second half of 1995 and a slight increase of credit demand over supply. This finding is consistent with recent survey results in which only 10 percent of firms in the manufacturing sector and 8 percent of firms in the services sector--including small and medium sized firms--reported financing difficulties.

## VI. CONCLUDING REMARKS

In this paper, the empirical significance of a credit crunch in Finland following the banking crisis was analyzed using monthly data on financial sector indicators. The results of the disequilibrium analysis for business credit suggest that the marked reduction in bank lending during the 1990s has been mainly in reaction to a cyclical decline in credit demand, reflecting partly the high level of indebtedness of the borrowers. It also appears that banks have become less willing to supply credit during periods associated with a deterioration in asset quality, erosion of rents accruing to banks due to declining regulatory protection from competition, as well as a need to increase capital adequacy levels. The episodes of a reduction of supply relative to demand, such as in 1994, has been accompanied by a rise in the spread between the bank lending rate and the marginal cost of bank funding. Survey results provide some evidence that banks increased collateral requirements during 1994, toughening non-price credit terms. However, more recent surveys suggest that this process has stopped and that the percentage of firms which face difficulty in accessing credit has declined to less than 10 percent. In sum, the current situation in the Finnish credit market does not seem to suggest the presence of a credit crunch.

### DESCRIPTION OF DATA

This appendix provides the description of the data used in the empirical analyses.

**Credit to business sector by banks:** Monthly data on domestic currency and foreign currency lending to the business sector. Source: Bank of Finland.

**Lending rate:** Monthly data on the weighted average of the lending rate linked to different rates. Source: Bank of Finland.

**Deposits:** Monthly data on total deposits. Source: Bank of Finland.

**Corporate net worth:** Market capitalization of listed equities. Annual data was extrapolated using seasonal adjustment variables. Source: Bank of Finland.

**Inflation:** Monthly data on the log of the Finnish consumer price index. Source: IFS (line 64), International Monetary Fund.

**Relative share price index:** Monthly data for the ratio of share price index for the banking sector relative to the stock market average. Source: Bank of Finland.

**Interest differential:** Monthly data for the difference between the lending rate and the 3-month HELIBOR rate. Source: Bank of Finland.

**Expected investment:** Quarterly data on survey results on expected investment by businesses. The data was extrapolated using seasonal adjustment variables. Source: Bank of Finland.

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