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PERSISTENCE OF GOVERNMENT FUNDING IN SMALL BUSINESS FINANCE**

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ABSTRACT: This paper studies the interaction of Finnish manufacturing firms and a state-owned specialized financing company, whose objective is to cure credit market imperfections. The study examines how the presence of such agency affects the behavior of the firms over time. Specifically, the study analyzes whether the observed persistence in the subsidized financing originates from true state dependence or unobserved firm-specific heterogeneity. The results show that there is positive state dependence in the granted government loans and guarantees. The findings indicate that the private sector agents may adjust their financing behavior in response to the government intervention in the credit markets. The unobserved firm-specific heterogeneity accounts for much of the observed persistence, which provides another reason for why some firms are more dependent on the government funding than the others.

Keywords: credit market imperfections, small business finance, government funding
JEL codes: G21, G24, G32, H81

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TIIVISTELMÄ: Tutkimuksessa tarkastellaan suomalaisten teollisuusyritysten ja luottomarkkinoiden epätäydellisyyksiä korjaamaan asetetun valtion erityisrahoitusyhtiön kanssakäymistä. Tutkimus tarkastelee, kuinka julkisen rahoittajan läsnäolo vaikuttaa yritysten käyttäytymiseen yli ajan. Tutkimuksessa analysoidaan, johtuuko julkisen yritysrahoituksen käytössä havaittu pysyvyys ns. todellisesta tilariippuvuudesta vai havaitsemattomasta yrityskohtaisesta heterogeenisuudesta. Tulosten mukaan myönnetyssä julkisessa lainarahoituksessa ja takauksissa on positiivista tilariippuvuutta. Havainnot viittaavat siihen, että yksityisen sektorin osapuolet saattavat muuttaa rahoituskäyttäytymistään luottomarkkinoille suunnatun julkisen intervention seurauksena. Merkittävä osa havaitusta pysyvyydestä selittyy havaitsemattomalla yrityskohtaisella heterogeenisuudella, mikä tarjoaa lisäselityksen sille, miksi jotkin yritykset ovat muita yrityksiä riippuvaisempia julkisesta yritysrahoituksesta.

Avainsanat: luottomarkkinoiden epätäydellisyydet, pk-yritysten rahoitus, julkinen yritysrahoitus
JEL koodit: G21, G24, G32, H81

1 Introduction

The common wisdom states that the credit markets may not function ideally in the case of young and small firms. A widely held view suggests that such market imperfections constraint the growth of small and medium-sized firms (e.g. Beck and Demirguc-Kunt 2006). Two rationales have been proposed for the government intervention in the markets for small business finance (e.g. Lerner 1999). The first rationale is based on financial constraints. The corporate finance literature suggests that small firms are more likely to face financial constraints than large firms (e.g. Beck and Demirguc-Kunt 2006; Beck et al. 2006; Berger and Udell 1998). Small and young firms tend to be informationally opaque, which makes them vulnerable to the problems of asymmetric information when they try to obtain external finance. The firms may also have little assets to pledge as collateral early in their growth cycle. (Berger and Udell 1998.) The second rationale is based on positive externalities. Subsidizing of small high-technology firms could generate R&D spillovers that would benefit other firms and the whole economy (Lerner 1999, 2002). This study concentrates on the financial constraint rationale of the government intervention in the credit markets.

The publicly supported lending schemes aim to provide funding for firms that are unable to obtain private financing. However, little is known how such policies affect the behavior of the private sector agents over time. This study aims to overcome this gap in the literature. The current paper studies the persistence in government loans and guarantees granted for Finnish manufacturing firms on the rationale of market failures. The study employs an extensive register-based panel of manufacturing firms matched to the financing decision data of a major state-owned specialized financing company, Finnvera plc. This provides a unique case for an evaluation of credit market policies. As stated in the law[1], the company has been given an objective to cure imperfections in the markets for small business finance. In order to fulfil this objective, the company provides loans, guarantees and other financing especially for small and medium-sized firms. Given this objective, a question arises how the presence of such agency affects the behavior of the firms over time. In particular, it is of interest whether the earlier subsidized firms tend to remain subsidized also in the future.

The adverse selection theories provide conflicting predictions on the nature of the credit market failure. Stiglitz and Weiss (1981) show that when the banks cannot distinguish good bor-

[1] Acts 443/1998 and 445/1998

rowers from bad ones, they may ration credit rather than increase interest rates to avoid adverse selection. In contrast, de Meza and Webb (1987) show that when the good borrowers cross-subsidize the bad ones who pool with the good ones, too many bad projects get funding. It remains unclear whether there exists too much or too little lending in market equilibrium. Also, a fundamental question remains whether the government could improve the market outcome (e.g. de Meza 2002; Parker 2002). The existence of private banks has been rationalized by their comparative advantage in the mitigation of informational asymmetries (e.g. Diamond 1984). Lerner (2002), however, suggests a rationale for the government intervention: the certification hypothesis. The screening conducted by a public financier could provide a signal to private investors about the quality of the project (Lerner 2002; Takalo and Tanayama 2010). If the government could certify the informationally opaque firms to private investors, the financing constraints could be relaxed (Lerner 1999). The certification hypothesis implies that the signal value of the subsidies is likely to be most beneficial in high-technology industries where standard financial statement analysis may be of little use (Lerner 1999, 2002).

Lerner (2002) observes that public venture capital programs tend to be associated with underperforming firms that have obtained a stream of public funds. Among other distortions, the firms seem to learn from the application process over time, which makes them more likely to obtain subsidies also in the future (Lerner 2002). The certification hypothesis, however, implies that the marginal signal value of the additional subsidies is decreasing (Lerner 1999). If the firm is revealed to be of good type, the additional subsidies provide little new information to the private financial intermediaries. The certification requires that the certifier must have incentives to become informed and credibly convey this information to the uninformed investors (Megginson and Weiss 1991; Tirole 2006, 250). If the government certifies the firms by financing them and the quality of the firms is revealed, the private investors would then know which firms are good rather than bad and would confidently invest in them. This would reduce the likelihood that the firms need to remain subsidized in the future periods. However, theories of reputation formation suggest that the informational asymmetries may take time to resolve if there is widespread adverse selection (e.g. Diamond 1989).

Diamond (1989) shows that incentive problems are most acute in the early periods of firm's existence, while such problems diminish over time for the borrowers who acquire a good reputation. If there is little adverse selection, the reputation effect could work immediately (Diamond 1989). If there is widespread moral hazard, new borrowers begin their reputation

acquisition by enlisting a monitor (Diamond 1991). An active monitor could help to resolve the information problems and allow firms with weak balance sheets to make investments (Tirole 2006, 356-359). The monitor's stake in the firm could certify that the borrower is sound, which would allow the firm to obtain additional capital from the less informed investors (Holmström and Tirole 1997). However, free riding could occur in the monitoring activity, if the banks' stake is too small to induce monitoring effort (cf. Tirole 2006, 480). The monitoring role of the public financier could imply some persistence in the subsidizing financing. However, if such persistence is related to unobserved firm-specific risk characteristics, it should be captured when the unobserved heterogeneity is controlled for.

This paper analyzes empirically the role of the government in the mitigation of informational asymmetries in the credit markets. The study focuses on the state-owned specialized financing company Finnvera plc. The current empirical framework provides a unique case to evaluate the certification and monitoring roles of the public financier. First, the main objective of the company is to cure market failures in the small business loan markets. This provides a sound rationale to concentrate on the financial constraint argument of the government intervention.[2] Second, the company aims to take an active role as an information producer. It takes a stake in the firms that it screens and monitors by providing direct lending to them and bearing part of the risks of private financial institutions. This provides a close empirical analogue for the certification and monitoring paradigm.

The study employs dynamic discrete choice panel models to analyze whether the observed persistence in the subsidized financing originates from the true state dependence or unobserved firm-specific heterogeneity. This distinction is crucial. A causal relationship would indicate that the subsidized firms behave differently in the future in comparison to otherwise identical non-subsidized firms (cf. Arulampalam et al. 2000). However, persistence could also arise from the unobserved firm-specific heterogeneity such as risk characteristics. The study applies a number of dynamic discrete choice panel models on a large panel of Finnish manufacturing corporations over the period 2000-2008. The results show that there is positive state dependence in the granted government funding. That is, the earlier subsidized firms are more likely to be subsidized than the other firms. The previous guarantee clients are 2.3-3.4 times as likely to obtain guarantees in the current period as the other firms. The earlier loan clients

[2] This is the approach taken also by Hall and Lerner (2009). They highlight the argument that there is often a wedge between the rates of return required by an entrepreneur and external investors, which could result in excessive cost of external capital.

are 20% more likely to obtain loans in the current period than the rest of the firms. The results also indicate that the unobserved permanent firm-specific characteristics still account for a considerable fraction of the dynamics observed in the data.

The findings suggest several implications: First, the positive state dependence estimates reject the hypothesis about the immediate certification function of the government funding. If the subsidies provide an accurate signal ('stamp of approval', see Lerner 2002) that the firms are of good type, there would be no further demand for the subsidies. The firms would then obtain future funding from the private financial intermediaries. However, the finding that the earlier subsidized firms are more likely to apply and receive government funding suggests otherwise. The signal about the borrower quality may be noisy (see e.g. Tirole 2006, 250). Second, the results remain consistent with the monitoring role of the public financier. If there is widespread adverse selection or moral hazard, the informational asymmetry could take time to resolve (Diamond 1989, 1991). The borrowers subject to moral hazard would obtain monitored financing (Diamond 1991). However, the unobserved riskiness of the firms is controlled for in the model in addition to the observed firm characteristics. The findings of positive state dependence suggest that the firm-specific characteristics alone are not able to explain the results.

Third, the finding that the earlier subsidized firms are more likely to be subsidized than the otherwise identical non-subsidized firms is consistent with the prediction of Lerner (2002). The finding provides empirical support for the learning behavior of the subsidized firms. The finding is not inconsistent with the monitoring role of the public financier. Rather, it implies that some firms resort to the government funding due to habit, perhaps because such financing could be easier to come by. Fourth, the state dependence observed in the case of guarantees suggests that part of the persistence may also be related to the behavior of the private financial intermediaries. In particular, free riding may occur in the monitoring activity in the presence of multiple lenders (Diamond 1984; see also Lelarge et al. 2008). Gale (1990a) shows that banks may *increase* credit rationing as an equilibrium response to the government intervention in the credit markets. The intervention could result in a paradoxical situation where subsidies generate demand for more subsidies (Gale 1990b).

The results suggest that the government should take into account the responses of the private sector agents when framing its credit market policies (see also Parker 2002). The expected benefits from a policy intervention could be diluted if the firms and banks adjust their behavior in response. Since the fundamental mission of the public financier is to cure credit market

failures, the findings of positive state dependence seem curious. The information problems should diminish over time (e.g. Diamond 1989). However, the unobserved firm-specific heterogeneity still captures a considerable fraction of the observed persistence. These unobserved permanent firm characteristics provide another reason for why some firms are more dependent on the government monitoring than the others. This holds a lesson for the previous empirical corporate finance literature (e.g. Fazzari et al. 1988) that attempts to distinguish financially constrained firms from the observed firm characteristics.

The rest of the paper is organized as follows: Section 2 provides the institutional details. Section 3 describes the dataset. Section 4 describes the empirical framework. Section 5 presents the empirical results. Section 6 concludes.

2 Institutional environment

The Finnish financial system has traditionally been bank-based (see e.g. Hyytinen et al. 2003). Despite the changes in the corporate finance environment, the financing of small and medium-sized firms has continued to rely on intermediated credit and government funding sources (e.g. Hyytinen and Väänänen 2006). Besides the specialized financing company Finnvera plc on which this study focuses, the prominent Finnish state-owned organizations that operate in the markets for small business finance consist of the following organizations (see e.g. Murray et al. 2009): Tekes, the Finnish Funding Agency for Technology and Innovation, provides R&D financing in the form of subsidies, loans and capital loans. The Finnish Innovation Fund Sitra provides direct venture capital investments and investments in the venture capital funds. Finnish Industry Investment Ltd provides also investments for venture capital funds and direct venture capital investments. The Centres for Economic Development, Transport and the Environment (former Employment and Economic Development Centres) provide grants and other support for the firms.

This study uses the financing decision data of Finnvera plc. The company is fully owned by the State of Finland. The company provides loans, guarantees, venture capital and export credit guarantees for its client firms. The study focuses on the domestic operations of the company. The objectives of the company are written in the acts 443/1998 and 445/1998. According to the law, the mission of the company is to provide financing especially for small

and medium-sized firms in order to promote the development, internationalization and exports of the enterprises. The company is also required to promote the regional policy goals of the State. The operations of the company should be focused on overcoming deficiencies in the supply of financial services.[3] Because of the state ownership, the company is required to follow the EU state aid regulations.[4]

The company provides loans and guarantees especially for small and medium-sized firms. Large firms can obtain funding only for special reasons. The credit can be granted with non-protective collateral or without collateral. The company follows the policy guidelines set by the State. When making a financing decision, the company takes into account the economic, regional and employment aspects of the project. The loans and guarantees should be allocated in order to cure deficiencies in the supply of financial services. The company should also take into account the possibilities to share risks with other financiers. The agency is required to pay careful attention on the profitability potential of the financed firms. The differences in the regional development are taken into account in the contract terms.[5] The client firms can obtain domestic and EU subsidies for the interest rate and guarantee commission expenses. These subsidies are based on various regional and industrial policies.[6] The regional subsidies are available in the assisted areas, while the subsidies for the special loans are available in the whole country.[7]

The mission of the company is to complement financial markets. Given the objectives written in the law, the principle rule of the company is to share risks with other financiers. The financial policy of the company is to provide up to 50% of the project- or firm-specific funding. The share can be higher than that in working capital financing, micro financing and projects that are considered significant in terms of industrial policy. Given the state aid regulations, the amount covered by guarantees can be at maximum 80% of the total debt commitment.[8] The company should aim for self-suficiency in its operations in the long run.[9] However, the State covers a part of the credit losses of the company.[10] The amount of credit loss compensation is highest in the assisted regions and it varies regionally between 40-65% of the realised losses.

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[3] 443/1998, 1§
[4] 445/1998, 2§
[5] 445/1998, 2§-3§, 6§
[6] 445/1998, 8§
[7] 11/023/2006, 12/023/2006
[8] Memo of the regulation, signed at 23.1.2009. Obtained from www.finnvera.fi.
[9] 443/1998, 4§
[10] 445/1998, 8§

The credit loss compensation can rise up to 80% with the compensation provided by the European Regional Development Fund (ERDF). Since 2005, growth firms have also been covered with higher credit loss compensation.[11]

The company has a network of 15 regional offices dispersed over the country. The firms apply the loans and guarantees directly from the agency. However, banks apply micro guarantees on the behalf of the firms. The agency conducts company analysis for the applicant firms. The company analysis contains financial statement analysis and it covers, for instance, the profitability potential of the business, firm's competitiveness and market conditions.[12] The analysis evaluates firms's management, business and finances. The credit risk classification system defines a credit rating for each client firm. These ratings are based on the long-term observations of the events of insolvency for each risk category. The risk classification scale has seven categories for operating firms and one for insolvent firms. The account manager evaluates the credit risk, applies the risk classification and prepares the financing proposal when making the financing decision. The credit rating is updated at least every second year. The value of the available collateral is evaluated in a similar fashion. The company monitors its risk-taking monthly.[13] The fact that the company screens the applicants, has a wide regional coverage and uses active risk-management practices[14] suggests that there is practical relevance for both the screening and monitoring roles of the public financier.

In 2008, the total domestic lending volume of Finnvera was 1027,8 million euros. Of this amount, 467,6 million euros were allocated for loans and 438,3 million euros for guarantees. The share of the total financing allocated for the manufacturing industry was 599,4 million euros (58,3%). Overall 437,6 million euros (42,6%) of the total financing were allocated for the regional support areas. The combined impairment and credit losses were 3,4% (77,8 million euros) and 2,2% (49,5 million euros) of the outstanding loan and guarantee commitments (2265,1 million euros) before and after the credit loss compensation, respectively. Most of the outstanding commitments were rated between B1-B3 on the risk classification scale from A1 to D.[15]

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[11] Official document on the credit loss compensation obtained from Finnvera.
[12] See the website of the company for further details.
[13] Finnvera Financial Review 2008, 19-20.
[14] see also Finnvera plc: An international evaluation. Ministry of Trade and Industry Publications. 1/2004.
[15] Finnvera Annual Review 2008, 7-9, 22-23; Finnvera Financial Review 2008, 6.

3 Data

3.1 Data sources

The study employs an extensive panel dataset of Finnish manufacturing corporations over the period 2000-2008. The dataset is based on register data obtained from the research laboratory of Statistics Finland. The dataset is constructed from multiple sources. The loan and guarantee decision data of Finnvera are obtained from the business subsidy database. This database covers the subsidies, loans and guarantees provided by the Finnish state-owned institutions since the year 2000. The data is collected directly from the institutions. The financing decision data of Finnvera contains the amount of granted and rejected loans and guarantees summed each on a yearly basis, the number of projects, the application period and indicators for the reason for the funding.[16]

Firm characteristics of net sales, employment, size classification, age, industry, location, exports and ownership information are obtained from the business register, which covers the population of Finnish enterprises. The business register is based on the data provided by the admistrative data sources. The most important data source is the Tax Admistration. The business register data has been supplemented with additional enquiries made by Statistics Finland. Financial statement data on EBITDA, fixed assets and total assets are obtained from the financial statement panel. This data is based on the information provided by tax authorities and enquiries made by Statistics Finland.

3.2 Construction of the sample

The sample is constructed using the business register as a master dataset. The business subsidy database and financial statement data are match merged to the business register data based on an encrypted company identification code and statistical year. The resulting dataset contains both subsidized and non-subsidized firms. In the case of Finnvera's approved and rejected financing decisions, a match was found in the business register in 76,4% of the cases. This includes firms of all legal forms and industries. The estimation sample is restricted to corporations that operate in the manufacturing industry. This translates into corporations that have a

[16] The primary reason is always "extension of operations". There are also indicators for whether the secondary reason was "regional equality", "equality between men and women" or "environmental effects".

two-digit Standard Industrial Classification (SIC) 2002 code within the values of 15-37. This industry group is the largest client group of the company in terms of lending volume. Given the lack of SIC 2002 code for the year 2000, the following year's industry code was used for that particular year.

Firms with missing observations or observations coded as unknown in the explanatory variables were dropped. This removes also firm observations with net sales, a sum of entrepreneurs and employees or total assets coded as zero for any other reason over the study period of the variables. The financial statement panel contains some corrections made by Statistics Finland for erroneous and missing values that might have existed in the raw data. In order to guarantee the representativeness of the sample, these observations are kept in the sample. A few observations with illogical values were dropped accordingly. The study concentrates on the regions of the mainland Finland. The autonomous province of Åland was excluded from the sample given its low amount of observations.

The final estimation sample consists of a balanced panel of the remaining firms that existed over the whole period 2000-2008. The main analysis concentrates on this sample, since the econometric models require consecutive time periods and a common entry year into the panel. Of the firms that existed over the whole study period 2000-2008, overall 238 firms were lost due to the missing data or other restrictions made to the dataset as described above. The robustness tests in section 5.2 show that the transition probabilities remain very similar in the balanced panel relative to the unbalanced one. An alternative balanced panel covering the period 2000-2006 is also used for comparison in the econometric analysis. This alternative sample is used to confirm that the results are not significantly affected by attrition during the later periods. In order to eliminate the influence of outliers, the calculated financial statement ratios have been winsorized as discussed below.

3.3 Descriptive statistics

The final sample consists of a balanced panel of 7999 manufacturing corporations over the period 2000-2008.[17] Of these firms, 2095 firms have obtained either a loan or guarantee from Finnvera at least once over the study period. When separated between the instruments, the

[17] Based on the business register statistics, there existed 13 732 manufacturing corporations in 2001. Of these firms, 8237 existed over the whole period 2000-2008. In total 238 firms were removed from the balanced panel due to data reasons including also firms that were located in Åland. This results in a balanced panel of 7999 firms.

amount of loan clients is 1580, while the amount of guarantee clients is 1171.[18] The financing decisions are summed for each firm on a yearly basis. There are overall 3474 loan observations and 3198 guarantee observations in the sample. The analysis focuses on the granting decision rather than modeling the application and granting decisions separately. There are good reasons for this. First, the amount of rejected applicants is negligible.[19] Second, the actual rejections cannot necessarily be reliably distinguished from the data. When the granted funding is added up on a yearly basis, the median amount of loans is 120 000 euros, while the median amount of guarantees is 146 703.5 euros.

An alternative sample covering the period 2000-2006 contains 9036 firms, of whom 2206 firms have obtained either loans or guarantees from Finnvera. In this sample, the amount of loan and guarantee clients is 1652 and 1193, respectively. While the overall number of firms drops in the main sample, these figures show that the number of lost client firms is not large in relative terms. The alternative sample uses alternative financial statement data for EBITDA, fixed assets and total assets.

Table 1 Variable definitions and descriptive statistics

Variable	Definition	Mean	Std	Obs
Obtained loan	Dummy for whether the firm was granted a positive amount of loans at t	0,048	0,214	71991
Obtained guarantee	Dummy for whether the firm was granted a positive amount of guarantees at t	0,044	0,206	71991
Obtained loan or guarantee	Dummy for whether the firm was granted a positive amount of loans or guarantees at t	0,082	0,275	71991
Age	Age in years at t	16,458	11,437	71991
ln(Sales)	Natural logarithm of net sales in euros at t-1	13,257	1,818	63992
Profitability	Ratio of EBITDA (earnings before interest, taxes, depreciation and amortization) to total assets at t-1 *	0,147	0,22	63992
Tangibility	Ratio of fixed assets to total assets at t-1 *	0,387	0,243	63992
Exporter	Dummy for firms with export activities at t-1	0,075	0,264	63992
Foreign	Dummy for foreign ownership at t-1	0,028	0,164	63992
Group	Dummy for belonging to a business group at t-1	0,122	0,327	55993
Growth	Log growth of net sales from t-2 to t-1 *	0,037	0,284	55993

Note: Pooled data on the estimation sample for the period 2000-2008. Source of data: Statistics Finland.
* Winsorized at the 1st and 99th percentiles

Table 1 reports the variable definitions and descriptive statistics for the pooled estimation sample over the period 2000-2008. The financing decision indicators take a value equal to

[18] The unbalanced panel of manufacturing corporations over the period 2000-2008 covers in total 4175 client firms, of whom 2971 and 2321 have obtained loans and guarantees, respectively, after the data cleaning. This process removed 63 client firms of whom 46 and 29 had obtained loans and guarantees, respectively.

[19] There were only 17 observations in the sample for the rejected applicants that did not receive any funding during the rejection year.

unity at the period the firm is granted a positive amount of funding and zero otherwise. The sample averages of obtaining loans, guarantees or either of them are 4,8%, 4,4% and 8,2%, respectively. Age of the firms is measured in years at the current period. The sample firms are on average 16,5 years old. The rest of the control variables are measured at the end of the previous period. The firm size is measured as a natural logarithm of net sales. The median net sales is 487 970 euros. Alternative size measures are also provided here for comparison. The median amount of personnel is 4,7. Based on the official EU size classifications, 66,7% of the observations belong to micro firms, 20,6% to small firms, 7% to medium-sized firms and 5,7% to large firms.

Profitability is measured as a ratio of EBITDA to total assets. The mean profitability is 14,7%. Tangibility of assets is measured as a ratio of fixed to total assets. The mean ratio of fixed to total assets is 38,7%. An indicator for exporter firms denotes firms that had export activities as defined in the business register. In total 7,5% of the firms had export activities. An indicator for foreign ownership measures firms that had a foreign ownership as defined in the business register. The mean amount of firms that had foreign ownership is 2,8%. The growth of the firms is measured as a log growth of net sales from period t-2 to period t-1. The mean sales growth is 3,7%. An indicator for firms that belong to a business group is also included. The mean amount of the sample firms that belong to a business group is 12,2%. The calculated financial ratios are winsorized at the 1st and 99th percentiles as indicated in the table. The sample firms look like what one would expect from a sample of smallish manufacturing firms.

Table 2 Obtained loans

Number of time periods	Number of firms	% of financed firms
0	6419	
1	723	45,76 %
2	393	24,87 %
3	200	12,66 %
4	118	7,47 %
5	54	3,42 %
6	46	2,91 %
7	26	1,65 %
8	15	0,95 %
9	5	0,32 %

Table 3 Obtained guarantees

Number of time periods	Number of firms	% of financed firms
0	6828	
1	533	45,52 %
2	189	16,14 %
3	126	10,76 %
4	88	7,51 %
5	59	5,04 %
6	62	5,29 %
7	45	3,84 %
8	46	3,93 %
9	23	1,96 %

Table 4 Obtained either loans or guarantees

Number of time periods	Number of firms	% of financed firms
0	5904	
1	825	39,38 %
2	415	19,81 %
3	248	11,84 %
4	190	9,07 %
5	111	5,30 %
6	98	4,68 %
7	80	3,82 %
8	77	3,68 %
9	51	2,43 %

Tables 2-4 report the statistics for obtaining positive financing decisions from Finnvera for a balanced panel of manufacturing corporations observed over the period 2000-2008. The tables report the number of time periods the firm was granted funding, the number of firms in each group and the percentage of such firms of the total number of the financed firms. The calculations are reported separately for loans, guarantees and the whole client group, respectively. Source of data: Statistics Finland.

Tables 2-4 report the patterns for obtaining positive financing decisions from Finnvera for the sample firms over the period 2000-2008. The tables report the number of time periods the firm was granted funding, the number of firms in each group and the percentage of such firms of the total number of the financed firms. The calculations are reported separately for loans, guarantees and the whole client group, respectively

Table 2 shows the patterns for obtaining positive loan decisions from Finnvera over the study period. Table 2 shows that 45,8% of the loan clients obtained loans only in one period. 29,4% of the clients obtained loans at least in three periods. 9,2% of the clients obtained loans at least in five periods, while 2,9% of clients obtained loans at least in seven periods. 0,3% of the loan clients obtained loans in every period.

Table 3 shows the patterns for obtaining positive guarantee decisions from Finnvera over the same period. Table 3 shows that 45,5% of the guarantee clients obtained a single contract during the study period. 38,3% of the clients obtained guarantees at least in three periods. 20,1 % of the guarantee clients obtained guarantees at least in five periods, while 9,7% obtained guarantees at least in seven periods. Overall 2% of the guarantee clients obtained guarantees in every period.

Table 4 shows the patterns for obtaining positive loan or guarantee decisions from Finnvera over the sample period. This covers the whole client group in the sample, since the firms can obtain both loans and guarantees. In the case of the client firms, 39,4% of the firms obtained funding only in one period. 40,8% of the clients obtained funding at least in three periods. 19,9% of the clients obtained funding at least in five periods. 9,9% of the client firms obtained some funding at least in seven periods. 2,4% of the client firms obtained funding in every period. The findings confirm that there are regular customers in the client group.

Table 5 Transition probabilities

Panel A: Loans

	0	1
0	96.66 (58773)	3.34 (2032)
1	70.22 (2238)	29.78 (949)

Panel B: Guarantees

	0	1
0	97.91 (59777)	2.09 (1279)
1	47.48 (1394)	52.52 (1542)

Panel C: Pooled loans and guarantees

	0	1
0	95.62 (55990)	4.38 (2565)
1	52.20 (2838)	47.80 (2599)

Table 5 reports the transition probabilities for the funding granted by Finnvera for a balanced panel of manufacturing corporations over the period 2000-2008. The results are reported for (i) loans (ii) guarantees and (iii) pooled loans and guarantees, respectively. The transitions are calculated for two consecutive years. ”1” denotes that the firm has obtained a positive financing decision at the given time period, while ”0” denotes that it has not. Frequencies are shown in the parenthesis. Source of data: Statistics Finland.

Table 5 reports the transition probabilities for obtaining funding conditional on the state of the previous period. The frequencies are shown in the parenthesis. Based on the consecutive years, the previous period’s loan customers are 8.9 times as likely to obtain loans in the cur-

rent period as the rest of the firms. The firms that received guarantees in the previous period are 25.1 times as likely to receive guarantees in the current period as the others. In the case of the whole client group, those who obtained any funding in the previous period are 10.9 times as likely to obtain more funding in the current period as the other firms. The findings indicate that there is considerable persistence in the data.

Table 6 Transition probabilities (aggregated panel)

Panel A: Loans

	0	1
0	96.08 (28135)	3.92 (1147)
1	61.35 (1665)	38.65 (1049)

Panel B: Guarantees

	0	1
0	97.63 (29133)	2.37 (707)
1	47.96 (1034)	52.04 (1122)

Panel C: Pooled loans and guarantees

	0	1
0	95.22 (26540)	4.78 (1333)
1	48.73 (2009)	51.27 (2114)

Table 6 reports the transition probabilities for the funding granted by Finnvera for a balanced panel of manufacturing corporations over the period 2000-2008. The panel is aggregated at the two-year level. The results are reported for (i) loans (ii) guarantees and (iii) pooled loans and guarantees, respectively. The transitions are calculated for two consecutive periods. ”1” denotes that the firm has obtained a positive financing decision at the given time period, while ”0” denotes that it has not. Frequencies are shown in the parenthesis. Source of data: Statistics Finland.

Table 6 shows the transition probabilities for the aggregated panel that combines two individual years together as a single period. In this case, the loan and guarantee clients from the previous period are 9.9 and 22 times as likely to obtain more funding in the current period as the other firms, respectively. In the case of the whole client group, those who obtained funding in the previous period are 10.7 times as likely to obtain funding in the current period as the other firms. The results are very similar to those obtained from the yearly data. The findings show that there is persistence in the data regardless of the time unit of the panel.

It is important to note that the financing decision indicators measure new granted funding. Discussion with the personnel of Finnvera indicates that concerns about mechanical correla-

tion in the financing decisions could be largely relaxed. The guarantee contracts usually cover the whole loan period. In the case of permanent-term credit lines, two-year contracts are typically used. The firms need to reapply for each new contract. No serial decisions are made in the case of loan contracts, either. However, if the contract details need changes afterwards, it is possible that a new financing decision is made instead of adjusting the current contract if fundamental changes in the risk level appear.[20] Of course, the agency or firms could anticipate during the granting process that the credit could be extended in the future. The staged financing type of behavior should be less of a concern as the firms could also apply the future funding from the private financial intermediaries. However, it is important to take into account the firm-specific heterogeneity. The econometric analysis can control for both the observed and unobserved firm-specific characteristics.

4 Empirical model and estimation

4.1 Hypotheses and econometric specification

The econometric approach applies dynamic probit models to analyze the dynamic behavior of the subsidized firms. The model equation is defined as follows:

$$y_{it}^{*} = \underbrace{x_{it}'\beta}_{controls} + \underbrace{\gamma y_{it-1}}_{state\ dependence} + \underbrace{\alpha_i}_{\substack{unobserved \\ heterogeneity}} + \underbrace{u_{it}}_{error\ term} \qquad (1)$$

$$y_{it} = \begin{cases} 1 & if\ y_{it}^{*} > 0 \\ 0 & else \end{cases}$$

$$i = 1, \dots, N$$

$$t = 2, \dots, T$$

where y_{it} is an indicator for whether the firm i obtained government funding at the time period t, x_{it} is a vector of control variables, α_i is an unobserved time-invariant firm-specific effect and u_{it} is a random error term. The random effects specification assumes that the composite error term $v_{it} = \alpha_i + u_{it}$ is correlated between the periods as $\lambda = corr(v_{it}, v_{it-1}) = \sigma_\alpha^2/(\sigma_\alpha^2 + \sigma_u^2)$ for $t = 2, \dots, T$.

[20] The information is based on personal communication with the personnel of Finnvera.

The existence of state dependence in the financing decisions can be tested with the lagged dependent variable. The null hypothesis $\gamma = 0$ states that the current participation in the subsidized lending schemes does not affect the propensity to participate in the future. According to the null, persistence in the government funding could be accounted for the firm-specific heterogeneity rather than a causal effect. Such persistence could be interpreted as spurious state dependence (cf. Chay and Hyslop 2000, 2001). A potential explanation for such persistence could include some unobserved riskiness of the firms or nature of their projects. The null hypothesis states that these firm-specific characteristics alone could explain why some firms have a higher dependence on the financing and monitoring provided by the public financier.

The alternative hypothesis states that persistence arises because of the true state dependence. In this case, the current participation has a causal effect on the likelihood to participate in the future. Two alternative predictions arise about the sign of the lagged dependent variable once the firm-specific factors are controlled for. In the first hypothesis, the government certifies the firms to the private investors by financing them and this provides an accurate signal about the quality of the firms (cf. Lerner 1999, 2002; Tirole 2006, 250). The private investors would then know which firms are of good rather than bad type and would confidently invest in them also in the future periods. The currently subsidized firms would be less likely to resort to the government funding in the following period. This would predict *negative* state dependence, which indicates that $\gamma < 0$. The previous participation decreases the likelihood of the current participation.

In the second hypothesis, the government funding does not provide an accurate signal about the borrower quality and relax the financial constraints in the future periods. Because of the noisy signal, the private investors do not know for certain whether the firms are good or bad. If the government funding does provide an accurate signal, the entrepreneurs still prefer subsidized financing to solely private financing. Since the entrepreneurs learn from the application process over time, the past funding experiences increase the probability that they apply and receive more government funding in the current period (cf. Lerner 2002). This would predict *positive* state dependence, which indicates that $\gamma > 0$. The current participation increases the propensity of the future participation. This hypothesis is not inconsistent with the monitoring role of the public financier. However, if the need for resorting to the monitoring arises solely from the firm-specific reasons, one would not reject the null hypothesis.

The control variables are motivated by the earlier literature on financial constraints and capital structure. Beck et al. (2006) shows that size, age and ownership are the most useful predictors for financial constraints. Hyytinen and Pajarinen (2008) show that age provides a close empirical proxy for the informational opacity of firms. The variables for profitability and tangibility of assets are motivated by Rajan and Zingales (1995), who show that these variables tend to be correlated with leverage ratios. Myers and Majluf (1984) predict a negative association between leverage and profitability, since firms are likely to prefer internal funds to debt. The tangibility of assets is used as a measure of collateralizable assets. Two ownership controls are included in the model. The first ownership control is an indicator for foreign ownership. The foreign-owned firms are more likely to have a better access for external finance. The second ownership control is an indicator for firms that belong to a business group. Hoshi et al. (1991) suggests that firms in the business groups are less likely to suffer from capital constraints. An indicator for firms with export activities is also included. The exporter firms are more likely to face capital needs. The past sales growth controls for the growth orientation of the firms.

4.2 Unobserved heterogeneity and estimation

Several methodological issues arise in the identification of the state dependence. Persistence could arise either because of the true state dependence, unobserved heterogeneity or serially correlated error term (Greene 2002, 708). It is important to distinguish between the persistence caused by the true state dependence and unobserved heterogeneity. Ignoring the persistence that arises from the unobserved heterogeneity would result in an overstatement of the state dependence (Stewart 2007). Dynamic random effects probit models require also an assumption about the relationship between the initial observation y_{i1} and the heterogeneity term α_i. If the initial conditions are exogenous, then standard random effects methodology could be used. (Stewart 2007.)

However, a problem arises when the initial conditions are correlated with the unobserved heterogeneity. If the initial conditions are mispecified, the resulting estimate would be inconsistent and tend to overstate the amount of state dependence. (Chay and Hyslop 2000; Stewart 2007.) The bias is inversely related to the lenght of the panel. It could be a particularly acute issue in the panels with only a short time dimension. (Chay and Hyslop 2000.) This is likely to be a relevant issue in the current case. First, the pre-sample financing history is unobservable for most sample firms with the exception of start-up firms. Second, even when the entire

sample history of the process is known, the assumption about the exogenous initial conditions is still very strong (Wooldridge 2005, 40).

The study applies the dynamic probit estimator of Wooldridge (2005) to control for the initial condition problem. This approach is based on a conditional maximum likelihood estimator, which conditions on the initial observation y_{i1} in addition to the exogenous variables. The approach specifies a model for the unobserved heterogenity as $\alpha_i = a_0 + a_1 y_{i1} + z_i' a_2 + \xi_i$, where y_{i1} is the initial value of the lagged dependent variable, z_i contains variables correlated with α_i and ξ_i is an unobserved heterogeneity term uncorrelated with the initial condition. This estimator has the advantage that it can be implemented with standard econometric software. It is also computationally less burdensome than the alternative estimator of Heckman (1981). Wooldridge suggests using x_i in all time periods for z_i, while other specifications are also possible (see Arulampalam and Stewart 2009). Substituting the above into the equation (1) gives:

$$y_{it}^* = x_{it}'\beta + \gamma y_{it-1} + a_0 + a_1 y_{i1} + z_i' a_2 + \xi_i + u_{it} \qquad (2)$$

A number of region and industry dummies are included in z_i to control for the observed firm-specific heterogeneity that could be correlated with α_i. These dummies are likely to be relevant controls, since the subsidies are rationalized by regional and industrial policy reasons. Since there is little time variation in these dummies, the initial period values are used for the whole study period. The random effects methodology assumes a strict exogeneity of the rest of the control variables. This is a rather strong assumption, while there does not exist a simple solution for the issue in the applied literature. In particular, fixed effects estimation would not lead to consistent estimates in dynamic nonlinear models with unobserved heterogeneity (Wooldridge 2002). A rich set of covariates is included in the model in order to confirm that the persistence is not driven by observed firm-specific characteristics.

The marginal effects for the lagged dependent variable are calculated in a conventional fashion (cf. Stewart 2007; Wooldridge 2002, 2005). In the case of the Wooldridge estimator, the counterfactual outcome probabilities are estimated taking y_{it-1} as fixed at 1 and 0 as follows:

$$\hat{p}_1 = \frac{1}{N}\sum_{i=1}^{N} \Phi\left\{\left(x_{it}'\hat{\beta} + \hat{\gamma} + \hat{a}_0 + \hat{a}_1 y_{i1} + z_i'\hat{a}_2\right)\left(1-\hat{\lambda}\right)^{1/2}\right\},$$
$$\hat{p}_0 = \frac{1}{N}\sum_{i=1}^{N} \Phi\left\{\left(x_{it}'\hat{\beta} + \hat{a}_0 + \hat{a}_1 y_{i1} + z_i'\hat{a}_2\right)\left(1-\hat{\lambda}\right)^{1/2}\right\} \qquad (3)$$

Then, two comparisons are computed based on these estimates: the *average marginal effects* $(AME) = \hat{p}_1 - \hat{p}_0$ and the *predicted probability ratios* $(PPR) = \hat{p}_1/\hat{p}_0$. The multiplier $\left(1 - \hat{\lambda}\right)^{1/2}$ scales the random-effects probit coefficients into the same scale as the pooled probit coefficients (see Arulampalam 1999). The reported computations are averages across all the time periods.

5 Empirical results

5.1 Main results

The dynamic probit estimates are reported in tables 7-9. The estimates are reported for the pooled probit, standard random effects probit and Wooldridge's random effects probit estimator. The average marginal effects (AME) and predicted probability ratios (PPR) are computed for the lagged dependent variable. The coefficient estimates are unscaled, while the AMEs and PPRs are comparable between the estimators. All the specifications include two-digit industry dummies, provincial-level region dummies and year dummies, which are not reported. The Wald tests that the industry and region dummies are jointly equal to zero are provided in the tables. The random effects models are estimated using the adaptive Gauss-Hermite quadrature with 36 integration points. The accuracy of the quadrature approximation is confirmed for each specification.

The estimates for the loan decisions are reported in table 7. The pooled probit estimator provides a positive and highly significant estimate of the lagged dependent variable. The AME is 0.144. However, this simple estimator ignores the unobserved heterogeneity. The standard random effects estimator results in a positive and highly significant state dependence estimate, while the magnitude of the effect diminishes considerably. The AME is reduced down to 0.009. This estimator still assumes exogenous initial conditions. The Wooldridge estimator relaxes this assumption. Once the initial conditions are controlled for, the lagged dependent variable is no longer statistically significant. The initial condition of the lagged dependent variable is highly significant and has a large coefficient. This suggests that there is considerable correlation between the initial condition and unobserved heterogeneity. Taken together, the observed persistence in loans between two consecutive periods could be accounted for the unobserved firm-specific heterogeneity. The measure rho shows that the unobserved hetero-

Table 7 Dynamic probit estimates for loans

	(1)	(2)	(3)	(4)	(5)
	Pooled probit	Random effects probit	Wooldridge's random effects probit	Pooled probit	Wooldridge's random effects probit
Dependent variable	Obtained loan	Obtained loan	Obtained loan	Obtained loan	Obtained loan
Lagged dependent variable (t-1)	0.979***	0.144***	0.0465	0.953***	0.0453
	(0.0376)	(0.0378)	(0.0370)	(0.0400)	(0.0411)
Age	-0.00179	-0.00648	-0.00404	-0.00116	-0.00475
	(0.00250)	(0.00404)	(0.00393)	(0.00264)	(0.00411)
Age squared	-0.0000437	-0.00000195	-0.0000169	-0.0000364	0.00000189
	(0.0000342)	(0.0000562)	(0.0000552)	(0.0000351)	(0.0000569)
ln(Sales)	0.150***	0.222***	0.187***	0.189***	0.219***
	(0.00698)	(0.0116)	(0.0112)	(0.00870)	(0.0130)
Profitability	-0.285***	-0.233***	-0.196***	-0.377***	-0.237***
	(0.0520)	(0.0741)	(0.0735)	(0.0581)	(0.0821)
Tangibility	0.407***	0.363***	0.275***	0.442***	0.350***
	(0.0507)	(0.0726)	(0.0714)	(0.0543)	(0.0757)
Exporter	0.214***	0.226***	0.216***	0.189***	0.184***
	(0.0320)	(0.0437)	(0.0433)	(0.0344)	(0.0465)
Foreign	-0.972***	-1.283***	-1.126***	-0.922***	-1.097***
	(0.116)	(0.154)	(0.149)	(0.133)	(0.164)
Initial condition			1.235***		1.222***
			(0.0582)		(0.0614)
Growth				0.123***	0.0486
				(0.0413)	(0.0494)
Group				-0.445***	-0.465***
				(0.0487)	(0.0591)
_cons	-4.549***	-6.349***	-5.839***	-5.077***	-6.229***
	(0.122)	(0.200)	(0.191)	(0.142)	(0.212)
Wald test:					
Industry dummies	71.62	80.07	68.01	61.46	51.64
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Region dummies	414.7	441.72	356.19	377.39	313.37
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AME	0.144	0.009	0.003	0.134	0.003
PPR	5.08	1.22	1.06	4.91	1.06
NT	63992	63992	63992	55993	55993
rho		0.465	0.428		0.415
ll	-9833.1	-9265.6	-9011.7	-8306.4	-7700.5

The table reports the dynamic probit estimates for a balanced panel of Finnish manufacturing corporations over the period 2000-2008. The dependent variable is an indicator for whether the firm was granted a positive amount of loans by Finnvera at period t. The control variables are defined as follows: *age* is the age of the firm at t, *ln(sales)* is a natural logarithm of net sales at t-1, *profitability* is a ratio of EBITDA to total assets at t-1, *tangibility* is a ratio of fixed to total assets at t-1, *exporter* is an indicator for firms with export activities at t-1, *foreign* is an indicator for foreign ownership at t-1, *initial condition* is the initial value of the lagged dependent variable, *growth* is the growth of net sales from t-2 to t-1, *group* is an indicator for firms belonging to a business group at t-1. AME measures the average marginal effects for the lagged dependent variable. PPR measures the predicted probability ratio for the lagged dependent variable. NT is the number of observations in the sample. Rho measures the intraclass error correlation. The log-likelihood is denoted as ll. All the specifications include time, area and industry dummies, which are not reported. The Chi2-statistics for the Wald test that the industry and area dummies are jointly equal to zero are reported in the table [p-values in brackets]. Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors for the specifications (1) and (4) are corrected for the firm-level clustering. Source of data: Statistics Finland.

Table 8 Dynamic probit estimates for guarantees

	(1)	(2)	(3)	(4)	(5)
	Pooled probit	Random effects probit	Wooldridge's random effects probit	Pooled probit	Wooldridge's random effects probit
Dependent variable	Obtained guarantee	Obtained guarantee	Obtained guarantee	Obtained guarantee	Obtained guarantee
Lagged dependent variable (t-1)	1.828***	0.863***	0.680***	1.838***	0.667***
	(0.0381)	(0.0456)	(0.0427)	(0.0403)	(0.0478)
Age	-0.00858***	-0.0151***	-0.0146***	-0.0103***	-0.0197***
	(0.00282)	(0.00455)	(0.00459)	(0.00297)	(0.00473)
Age squared	0.0000369	0.0000813	0.0000655	0.0000679*	0.000148**
	(0.0000386)	(0.0000598)	(0.0000617)	(0.0000395)	(0.0000608)
ln(Sales)	0.171***	0.291***	0.238***	0.203***	0.256***
	(0.00739)	(0.0142)	(0.0137)	(0.00925)	(0.0158)
Profitability	-0.512***	-0.549***	-0.495***	-0.618***	-0.590***
	(0.0500)	(0.0838)	(0.0841)	(0.0555)	(0.0927)
Tangibility	0.176***	0.258***	0.227***	0.196***	0.263***
	(0.0532)	(0.0838)	(0.0837)	(0.0565)	(0.0891)
Exporter	0.245***	0.268***	0.251***	0.229***	0.219***
	(0.0342)	(0.0484)	(0.0485)	(0.0362)	(0.0523)
Foreign	-0.698***	-1.109***	-0.907***	-0.696***	-0.957***
	(0.109)	(0.150)	(0.147)	(0.116)	(0.165)
Initial condition			1.648***		1.758***
			(0.0802)		(0.0842)
Growth				0.110***	0.107*
				(0.0427)	(0.0550)
Group				-0.342***	-0.420***
				(0.0489)	(0.0648)
_cons	-4.593***	-7.206***	-6.463***	-4.991***	-6.628***
	(0.124)	(0.253)	(0.239)	(0.145)	(0.263)
Wald test:					
Industry dummies	106.19	106.54	80.88	92.98	68.94
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Region dummies	109.45	110.04	79.33	104.67	70.84
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AME	0.356	0.062	0.043	0.351	0.041
PPR	17.10	3.01	2.27	17.55	2.23
NT	63992	63992	63992	55993	55993
rho		0.518	0.495		0.476
ll	-7654.2	-7289.0	-7010.9	-6474.1	-5948.3

The table reports the dynamic probit estimates for a balanced panel of Finnish manufacturing corporations over the period 2000-2008. The dependent variable is an indicator for whether the firm was granted a positive amount of guarantees by Finnvera at period t. The control variables are defined as follows: *age* is the age of the firm at t, *ln(sales)* is a natural logarithm of net sales at t-1, *profitability* is a ratio of EBITDA to total assets at t-1, *tangibility* is a ratio of fixed to total assets at t-1, *exporter* is an indicator for firms with export activities at t-1, *foreign* is an indicator for foreign ownership at t-1, *initial condition* is the initial value of the lagged dependent variable, *growth* is the growth of net sales from t-2 to t-1, *group* is an indicator for firms belonging to a business group at t-1. AME measures the average marginal effects for the lagged dependent variable. PPR measures the predicted probability ratio for the lagged dependent variable. NT is the number of observations in the sample. Rho measures the intra-class error correlation. The log-likelihood is denoted as ll. All the specifications include time, area and industry dummies, which are not reported. The Chi2-statistics for the Wald test that the industry and area dummies are jointly equal to zero are reported in the table [p-values in brackets]. Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors for the specifications (1) and (4) are corrected for the firm-level clustering. Source of data: Statistics Finland.

geneity accounts between 41,5-46,5% of the total error variance in the case of loan decisions. The further analysis in section 5.2 captures longer term dynamics and provides evidence of positive state dependence. However, the short-term persistence analyzed here is dominated by unobserved permanent firm characteristics.

The estimates for the guarantee decisions are reported in table 8. The results provide consistent support for the existence of positive state dependence. The pooled probit estimator provides a highly significant coefficient for the lagged dependent variable. The AME is 0.356. The standard random effects estimator reduces the AME down to 0.062. The Wooldridge estimator further reduces the AME down to 0.043 while the PPR is 2.27. The guarantee estimates show that the funding experience from the previous period increases the probability of being subsidized by 4,3%. The previously subsidized firms are 2.3 times as likely to be subsidized in the current period as the non-subsidized firms. The unobserved heterogeneity captures a significant fraction of the dynamics as the comparison between the different specifications reveal. The initial condition variable has a large and highly significant coefficient. The measure rho shows that the unobserved firm-specific heterogeneity accounts between 47,6-51,8% of the total error variance in the case of guarantee decisions.

The control variable estimates provide details on the characteristics of the subsidized firms. Since these estimates are similar for the whole client group, they are discussed here together. The coefficient of age is negative but insignificant in the case of loans. It is negative and highly significant in the case of guarantees. The results provide only partial support for the prediction that the subsidized firms would be younger than average. However, note that the panel design restricts the entry of new firms into the panel after the initial time period. The coefficient of net sales is positive and highly significant. That is, the probability for obtaining government funding increases with size. The coefficient of profitability is negative and highly significant. In other words, less profitable firms are more likely to resort to government funding. Tangibility of assets has a positive and highly significant coefficient. This proxy for collateralizable assets indicates that the subsidized firms have more tangible assets in their balance sheets than the control firms. The findings that the subsidized firms are larger and have more tangible assets seem to contradict the predictions about the nature of the firms that are more likely to suffer from asymmetric information. It remains possible that the findings could reflect differences in the financial growth cycle of the firms.

The indicator for exporter firms is positive and highly significant. That is, the export-orientated firms are more likely to apply and receive government funding. The indicator for foreign ownership is negative and highly significant. The indicator for belonging to a business group has a negative and highly significant coefficient. Taken together, the subsidized firms tend to have an ownership structure that may provide fewer chances for the access to the capital markets. The coefficient of the past sales growth is positive but weakly significant in the case of guarantees and insignificant in the case of loans. There seems to be no robust evidence on the growth orientation of the subsidized firms once the unobserved characteristics are controlled for. The Wald tests that the area and industry dummies are jointly equal to zero are both rejected at the 1% level.[21] That is, the region and industry characteristics are found to be significant factors behind the financing decisions.[22] In summary, the control variable estimates seem sensible and largely correspond the expectations.

5.2 Robustness tests

The corporate finance literature predicts that firms with weak balance sheets or entrepreneurs with optimistic expectations tend to borrow on a short-term basis (e.g. Tirole 2006, 204; Landier and Thesmar 2009). However, the yearly horizon might not capture the full dynamics, since the maturity of the loans could be several years. The following analysis addresses concern. Here, the time unit of the panel is aggregated at the two-year level by combining two individual years together as a single period. The financing decision indicators now take a value equal to unity if the firm was granted funding during any of the two years that were combined together. A similar treatment is given for the indicators of exporter status and foreign ownership. A period-specific average is taken of the continuous covariates. The firm age is measured at the middle of the period. The aggregated panel provides a possibility to study the lag between the funding decisions up to four years at most. The analysis focuses on the Wooldridge estimator, since the initial condition issue is particularly acute in the short panels. The simulations of Arulampalam and Stewart (2009) show that this estimator continues to perform well in terms of bias in the panels with a similar time dimension.

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[21] The comparison point for the area dummies is Uusimaa. The comparison point for the industry dummies is the group ”manufacturing of foods, beverages and tobacco”. The groups ”tobacco” and ”foods and beverages” are combined together, while the group ”coke, refined petroleum products and nuclear fuel” is combined with the group ”chemical products and man-made fibres” because of the low amount of observations in the former groups.

[22] Strictly speaking, these time-invariant dummies cannot necessarily be given a causal interpretation in the Wooldridge estimator, as they are indistinguishable from the model of the unobserved heterogeneity.

Table 9 Dynamic probit estimates for loans and guarantees (aggregated panel)

	(1)	(2)	(3)	(4)
	Pooled probit	Wooldridge's random effects probit	Pooled probit	Wooldridge's random effects probit
Dependent variable	Obtained loan	Obtained loan	Obtained guarantee	Obtained guarantee
Lagged dependent variable (t-1)	1.153***	0.159***	1.806***	0.960***
	(0.0367)	(0.0530)	(0.0392)	(0.0693)
Age	-0.00297	-0.00414	-0.0122***	-0.0186***
	(0.00270)	(0.00464)	(0.00313)	(0.00465)
Age squared	-0.0000244	-0.0000205	0.0000772*	0.000127**
	(0.0000367)	(0.0000657)	(0.0000411)	(0.0000618)
ln(Sales)	0.142***	0.182***	0.151***	0.189***
	(0.00778)	(0.0137)	(0.00801)	(0.0148)
Profitability	-0.240***	-0.211**	-0.386***	-0.415***
	(0.0589)	(0.0936)	(0.0538)	(0.0901)
Tangibility	0.441***	0.441***	0.121*	0.163*
	(0.0588)	(0.0903)	(0.0651)	(0.0938)
Exporter	0.157***	0.142***	0.226***	0.247***
	(0.0356)	(0.0511)	(0.0402)	(0.0525)
Foreign	-1.052***	-1.321***	-0.695***	-0.884***
	(0.145)	(0.194)	(0.118)	(0.163)
Initial condition		1.365***		1.231***
		(0.0722)		(0.100)
_cons	-4.073***	-5.279***	-4.013***	-5.049***
	(0.130)	(0.231)	(0.135)	(0.256)
Wald test:				
Industry dummies	61.94	49.92	68.76	58.9
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]
Region dummies	356.66	247.72	96.66	65.6
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]
AME	0.206	0.013	0.367	0.090
PPR	5.80	1.20	15.50	3.35
NT	31996	31996	31996	31996
rho		0.446		0.387
ll	-6030.2	-5707.0	-4506.3	-4391.3

The table reports the dynamic probit estimates for a balanced panel of Finnish manufacturing corporations over the period 2000-2008. The panel is aggregated at the two-year level where one period consists of two individual years. The indicator variables are defined equal to unity if the condition holds in any of the two combined years. The continuous covariates are period-specific averages. The dependent variable in the specifications 1-2 (3-4) is an indicator for whether the firm was granted a positive amount of loans (guarantees) by Finnvera at period t. The control variables are defined as follows: *age* is the age of the firm at the middle of the period t, *ln(sales)* is a natural logarithm of net sales at t-1, *profitability* is a ratio of EBITDA to total assets at t-1, *tangibility* is a ratio of fixed to total assets at t-1, *exporter* is an indicator for firms with export activities at t-1, *foreign* is an indicator for foreign ownership at t-1, *initial condition* is the initial value of the lagged dependent variable. AME measures the average marginal effects for the lagged dependent variable. PPR measures the predicted probability ratio for the lagged dependent variable. NT is the number of observations in the sample. Rho measures the intra-class error correlation. The log-likelihood is denoted as ll. All the specifications include time, area and industry dummies, which are not reported. The Chi2-statistics for the Wald test that the industry and area dummies are jointly equal to zero are reported in the table [p-values in brackets]. Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors for the specifications (1) and (3) are corrected for the firm-level clustering. Source of data: Statistics Finland.

The results for the aggregated panel are reported in table 9. The estimates for the loan decisions now reveal evidence of the existence of positive state dependence. The lagged dependent variable is highly significant. The AME is 0.013 while the PPR is 1.20. The previous funding experience increases the probability for obtaining loans in the current period by 1,3%. The past loan clients are 1.2 times as likely to be subsidized in the current period as the other firms. The unobserved firm-specific heterogeneity remains an important factor behind the financing decisions. It would be beneficial to allow longer lag adjustment to capture a wider maturity range for the loans. However, the panel dimension does not provide such an opportunity. It seems likely that at least some of the differences between loans and guarantees are maturity related. The state dependence estimates for the guarantee decisions remain highly significant. The AME is 0.09, while the PPR is 3.35. That is, the previous funding experience increases the probability for obtaining guarantees in the current period by 9%. The earlier guarantee clients are 3.35 times as likely to be subsidized in the current period as the other firms. The findings suggest that the persistence is rather magnified than diminished over a longer term.

Table 10 Transition probabilities (unbalanced panel)

Panel A: Loans

	0	1
0	96.92 (91309)	3.08 (2904)
1	72.43 (3510)	27.57 (1336)

Panel B: Guarantees

	0	1
0	97.90 (92387)	2.10 (1978)
1	49.51 (2324)	50.49 (2370)

Panel C: Pooled loans and guarantees

	0	1
0	95.82 (86799)	4.18 (3791)
1	54.26 (4595)	45.74 (3874)

Table 5 reports the transition probabilities for the funding granted by Finnvera for a rectangularized unbalanced panel of manufacturing corporations over the period 2000-2008. The results are reported for (i) loans (ii) guarantees and (iii) pooled loans and guarantees, respectively. The transitions are calculated for two consecutive years. ”1” denotes that the firm has obtained a positive financing decision at the given time period, while ”0” denotes that it has not. Frequencies are shown in the parenthesis. Source of data: Statistics Finland.

Table 11 Dynamic probit estimates for loans

	(1)	(2)	(3)	(4)	(5)
	Pooled probit	Random effects probit	Wooldridge's random effects probit	Pooled probit	Wooldridge's random effects probit
Dependent variable	Obtained loan	Obtained loan	Obtained loan	Obtained loan	Obtained loan
Lagged dependent variable (t-1)	0.948***	0.176***	0.0137	0.913***	0.00986
	(0.0386)	(0.0437)	(0.0419)	(0.0417)	(0.0486)
Age	-0.00453*	-0.00991**	-0.00728*	-0.00453*	-0.00875**
	(0.00254)	(0.00397)	(0.00393)	(0.00271)	(0.00411)
Age squared	-0.0000114	0.0000417	0.0000281	0.00000604	0.0000600
	(0.0000374)	(0.0000603)	(0.0000598)	(0.0000373)	(0.0000607)
ln(Sales)	0.141***	0.211***	0.179***	0.179***	0.214***
	(0.00678)	(0.0112)	(0.0109)	(0.00876)	(0.0130)
Profitability	-0.406***	-0.429***	-0.373***	-0.493***	-0.426***
	(0.0550)	(0.0766)	(0.0767)	(0.0625)	(0.0870)
Tangibility	0.390***	0.389***	0.295***	0.425***	0.375***
	(0.0504)	(0.0719)	(0.0718)	(0.0552)	(0.0767)
Exporter	0.212***	0.236***	0.228***	0.186***	0.194***
	(0.0336)	(0.0459)	(0.0459)	(0.0367)	(0.0499)
Foreign	-0.862***	-1.187***	-1.024***	-0.824***	-1.003***
	(0.116)	(0.150)	(0.148)	(0.131)	(0.161)
Initial condition			1.240***		1.207***
			(0.0584)		(0.0638)
Growth				0.109***	0.0369
				(0.0420)	(0.0517)
Group				-0.448***	-0.498***
				(0.0505)	(0.0615)
_cons	-4.152***	-5.681***	-5.241***	-4.651***	-5.673***
	(0.116)	(0.189)	(0.181)	(0.139)	(0.209)
Wald test:					
Industry dummies	69.81	72.59	59.83	56.95	43.74
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.002]
Region dummies	412.29	407.53	331.07	352.27	267.6
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AME	0.142	0.012	0.001	0.131	0.001
PPR	4.83	1.28	1.02	4.61	1.01
NT	54216	54216	54216	45180	45180
rho		0.434	0.411		0.394
ll	-8710.6	-8390.8	-8120.4	-7059.0	-6672.2

The table reports the dynamic probit estimates for a balanced panel of Finnish manufacturing corporations over the period 2000-2006. The dependent variable is an indicator for whether the firm was granted a positive amount of loans by Finnvera at period t. The control variables are defined as follows: *age* is the age of the firm at t, *ln(sales)* is a natural logarithm of net sales at t-1, *profitability* is a ratio of EBITDA to total assets at t-1, *tangibility* if a ratio of fixed to total assets at t-1, *exporter* is an indicator for firms with export activities at t-1, *foreign* is an indicator for foreign ownership at t-1, *initial condition* is the initial value of the lagged dependent variable, *growth* is the growth of net sales from t-2 to t-1, *group* is an indicator for firms belonging to a business group at t-1. AME measures the average marginal effects for the lagged dependent variable. PPR measures the predicted probability ratio for the lagged dependent variable. NT is the number of observations in the sample. Rho measures the intraclass error correlation. The log-likelihood is denoted as ll. All the specifications include time, area and industry dummies, which are not reported. The Chi2-statistics for the Wald test that the industry and area dummies are jointly equal to zero are reported in the table [p-values in brackets]. Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors for the specifications (1) and (4) are corrected for the firm-level clustering. Source of data: Statistics Finland.

Table 12 Dynamic probit estimates for guarantees

	(1)	(2)	(3)	(4)	(5)
	Pooled probit	Random effects probit	Wooldridge's random effects probit	Pooled probit	Wooldridge's random effects probit
Dependent variable	Obtained guarantee	Obtained guarantee	Obtained guarantee	Obtained guarantee	Obtained guarantee
Lagged dependent variable (t-1)	1.881***	0.957***	0.607***	1.902***	0.574***
	(0.0402)	(0.0566)	(0.0492)	(0.0436)	(0.0584)
Age	-0.00951***	-0.0177***	-0.0167***	-0.0114***	-0.0225***
	(0.00297)	(0.00481)	(0.00519)	(0.00314)	(0.00546)
Age squared	0.0000420	0.0000992	0.0000732	0.0000822*	0.000181**
	(0.0000454)	(0.0000702)	(0.0000772)	(0.0000452)	(0.0000760)
ln(Sales)	0.165***	0.292***	0.249***	0.200***	0.274***
	(0.00736)	(0.0152)	(0.0148)	(0.00982)	(0.0178)
Profitability	-0.659***	-0.784***	-0.692***	-0.777***	-0.803***
	(0.0551)	(0.0900)	(0.0937)	(0.0630)	(0.108)
Tangibility	0.209***	0.294***	0.253***	0.245***	0.339***
	(0.0539)	(0.0873)	(0.0917)	(0.0580)	(0.101)
Exporter	0.205***	0.251***	0.228***	0.181***	0.195***
	(0.0362)	(0.0525)	(0.0546)	(0.0396)	(0.0611)
Foreign	-0.685***	-1.216***	-1.045***	-0.735***	-1.165***
	(0.113)	(0.164)	(0.170)	(0.125)	(0.201)
Initial condition			1.930***		2.080***
			(0.0932)		(0.106)
Growth				0.129***	0.110*
				(0.0467)	(0.0613)
Group				-0.395***	-0.519***
				(0.0521)	(0.0745)
_cons	-4.289***	-6.796***	-6.379***	-4.832***	-6.859***
	(0.122)	(0.270)	(0.255)	(0.154)	(0.299)
Wald test:					
Industry dummies	111.32	107.19	84.36	98.85	68.63
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Region dummies	86.83	89.2	61.86	80.54	54.16
[p-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AME	0.382	0.074	0.037	0.378	0.032
PPR	17.48	3.26	1.95	18.17	1.85
NT	54216	54216	54216	45180	45180
rho		0.524	0.547		0.541
ll	-6757.5	-6556.0	-6218.7	-5411.8	-5005.0

The table reports the dynamic probit estimates for a balanced panel of Finnish manufacturing corporations over the period 2000-2006. The dependent variable is an indicator for whether the firm was granted a positive amount of guarantees by Finnvera at period t. The control variables are defined as follows: *age* is the age of the firm at t, *ln(sales)* is a natural logarithm of net sales at t-1, *profitability* is a ratio of EBITDA to total assets at t-1, *tangibility* is a ratio of fixed to total assets at t-1, *exporter* is an indicator for firms with export activities at t-1, *foreign* is an indicator for foreign ownership at t-1, *initial condition* is the initial value of the lagged dependent variable, *growth* is the growth of net sales from t-2 to t-1, *group* is an indicator for firms belonging to a business group at t-1. AME measures the average marginal effects for the lagged dependent variable. PPR measures the predicted probability ratio for the lagged dependent variable. NT is the number of observations in the sample. Rho measures the intra-class error correlation. The log-likelihood is denoted as ll. All the specifications include time, area and industry dummies, which are not reported. The Chi2-statistics for the Wald test that the industry and area dummies are jointly equal to zero are reported in the table [p-values in brackets]. Standard errors in parentheses: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The standard errors for the specifications (1) and (4) are corrected for the firm-level clustering. Source of data: Statistics Finland.

The econometric results are conditional on the firm existing over the whole study period. This might raise a concern about potential sample selection due to a survivorship bias. In order to check whether the dynamics are sensitive to the requirement of a balanced panel, the transition probabilities for a rectangularized unbalanced panel are provided in table 10. This data allows the entry and exit in and out of the panel, while the other sample selection criteria remain identical. The differences are minor as the comparison between tables 5 and 10 reveal. The findings suggest that the dynamics are not significantly affected by the panel design.

For further robustness tests, the econometric results for the balanced panel covering the period 2000-2006 are also provided for comparison. This alternative dataset provides a further possibility to check whether the econometric results are sensitive to the study period or attrition during the later periods. This analysis focuses on the yearly horizon given the limited panel dimension of the dataset.

Table 11 shows that the state dependence estimates in the case of loan decisions are similar in the alternative dataset as earlier. The short-term persistence in the loans is related to the unobserved firm-specific heterogeneity. In the case of the control variables, the coefficient of age now reveals some weak evidence of statistical significance. However, the inference remains otherwise the same as earlier.

Table 12 shows that the state dependence estimates in the case of guarantee decisions are similar to the ones obtained from the main sample. The estimates are only slightly more conservative in the shorter sample. In this sample, those who obtained guarantees in the previous period are 1.95 times as likely to obtain more guarantees in the current period as the other firms. The control variable estimates remain robust in the alternative sample. In summary, the robustness tests confirm that the results are not significantly affected by the study period or attrition during the later periods.

5.3 Discussion

The results show that there is positive state dependence in the loan and guarantee decisions. The earlier loan clients are 20% more likely to obtain loans in the current period than the other firms when the time unit of the panel is aggregated to two years. The short-term persistence in the loans observed on a yearly horizon is accounted for the unobserved firm-specific heter-

ogeneity. The guarantee clients from the previous period are 2.3 times as likely to obtain guarantees in the current period as the rest of the firms. When the panel is aggregated at the two-year level, the estimates show that the earlier guarantee clients are 3.4 times as likely to obtain guarantees as the other firms. The unobserved firm-specific heterogeneity still remains an important factor behind the dynamics.

The findings provide several implications that are related to the previous corporate finance literature. First, the finding that the previously subsidized firms are more likely to be subsidized rejects the hypothesis about the immediate certification function of the government funding. If the government certifies the firms and this 'stamp of approval' (Lerner 2002) has an immediate effect, the private investors would then know which firms are good and would confidently invest in them. The subsidies do not seem to provide such a signal about the firms that would overcome the need to resort to more government funding in the future periods. If they do, the firms still prefer to resort to the subsidized financing. One interpretation is that the signal may be noisy. The government funding may not provide an accurate signal about the quality of the firms (cf. Tirole 2006, 250).

Second, the results remain consistent with the monitoring role of the public financier. The information revelation could take time in the presence of widespread adverse selection or moral hazard (Diamond 1989, 1991). However, the unobserved firm-specific risk characteristics are controlled for in the model in addition to the observed firm characteristics. The existence of state dependence in the government funding suggests that the firm-specific characteristics alone are not able to explain the findings. Third, the finding that the earlier subsidized firms are more likely to be subsidized is consistent with the learning behavior of the firms. Some firms seem to resort repeatedly to the government funding because of habit, maybe because such funding could be easier to come by. Lerner (2002) observed in the context of public venture capital awards that the firms gain insights in the application process over time. Lerner (2002) suggests that this and other distortions make the earlier subsidized firms more likely to be subsidized also in the future. The current study provides empirical support for this prediction in the credit markets context.

Fourth, the positive state dependence in the guarantees suggests that part of the persistence may also be related to the behavior of the private financial intermediaries. In particular, banks may reduce their own monitoring effort and free ride on the screening and monitoring effort

of the public financier (cf. Diamond 1984; Tirole 2006, 480; see also Lelarge et al. 2008). Gale (1990a, 1990b) shows that banks may reduce the unsubsidized loan provision for the subsidized target groups as an equilibrium response to the government intervention. The credit subsidies allocated to one target group may crowd out other target groups, who then increase their subsidy requests. This could result in a paradoxical situation where subsidies generate demand for further subsidies. (Gale 1990b.) Taken together, the results suggest that the private sector agents may adjust their financing behavior in response to the government intervention in the credit markets. Since the fundamental mission of the public financier is to cure market failures, the finding that the earlier subsidized firms are more likely to be subsidized seems curious. The information problems should diminish over time, even though this could take some time for the borrowers with no previous track record (Diamond 1989).

Finally, the findings show that the unobserved firm-specific heterogeneity still captures a considerable fraction of the dynamics. This implies that some firms are more dependent on the government monitoring due to unobserved permanent firm characteristics. Since the objective of the public financier is to finance firms that cannot obtain private financing, it seems reasonable to classify these firms as potentially financially constrained. In particular, it seems likely that the unobserved firm-specific risk characteristics could provide one explanation for the finding. This holds also a lesson for the corporate finance literature dating back to Fazzari et al. (1988) that attempts to identify financially constrained firms from the observed firm characteristics. An interpretation of the model of Diamond (1991) suggests that these repeated customers might be the ones whose credit rating is too low for the reputation to eliminate the moral hazard, but high enough for the monitoring to do so.

6 Conclusions

This paper studied the dynamics of government loans and guarantees granted for Finnish manufacturing firms on the rationale of credit market imperfections. The study analyzed whether the earlier subsidized firms tend to remain subsidized also in the future and whether such persistence originates from the true state dependence or unobserved firm-specific heterogeneity. This distinction is crucial as these alternative explanations suggest different policy implications. The results show that there is positive state dependence in the granted government funding. The previous

guarantee clients are 2.3-3.4 times as likely to obtain guarantees in the current period as the other firms. The earlier loan clients are 20% more likely to obtain loans in the current period than the rest of the firms. Taken together, the results show that the earlier subsidized firms are more likely to be subsidized than the other firms. The results also indicate that the unobserved firm-specific heterogeneity still accounts for a considerable fraction of the overall dynamics.

The findings suggest several implications: First, the positive state dependence rejects the hypothesis about the immediate certification function of the government funding. The subsidies do not seem to provide such a signal about the borrower quality (see Lerner 1999, 2002) that would eliminate the demand for the further subsidies in the future periods. The signal provided by the subsidies may be noisy. Second, while the results remain consistent with the monitoring role of the public financier, the findings cannot be explained with the firm-specific characteristics alone. Third, the finding that the earlier subsidized firms are more likely to be subsidized is consistent with the learning behavior of the firms as predicted by Lerner (2002). Some firms seem to resort to the subsidized financing due to habit, perhaps because such funding could be easier to come by. Fourth, it remains possible that the state dependence in the guarantees could also reflect the behavior of the private financial intermediaries. In particular, free riding may occur in the monitoring activity in the presence of multiple lenders (Diamond 1984). The banks may also reduce the unsubsidized loan provision as an equilibrium response to the government intervention (Gale 1990a, 1990b, 1991).

The results suggest that the government should take into account the responses of the private sector agents when framing its credit market policies (see also Parker 2002). The expected benefits from the intervention could be diluted if the firms and banks adjust their behavior in response. This implies that an extensive intervention is not likely to be a desirable policy direction. The role for the government is limited and related to the marginal sectors of the credit markets (Gale 1991). Since the fundamental mission of the public financier is to cure credit market imperfections, the findings of positive state dependence seem curious. The information problems should diminish over time (e.g. Diamond 1989). However, a considerable fraction of the overall dynamics still relates to the unobserved firm-specific heterogeneity. The unobserved permanent firm characteristics thus provide another reason for why some firms are more dependent on the government monitoring than the others. This holds a lesson for the previous empirical corporate finance literature (e.g. Fazzari et al. 1988) that attempts to identify financially constrained firms from the observed firm characteristics.

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