Policy-based Loans to Korean SME Exporters and the Intensive Margin of Exports[*]

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This study examines the extent to which policy-based loans to SME exporters affect their export performance (the intensive margin of exports). We also investigate the heterogeneous export effects of policy-based loans that may depend on firm- and industry-specific characteristics, such as credit ratings, debt-to-assets ratios, firm size and age. To do so, we conduct a survey, of 1,000 Korean SMEs, that collect information on firm-level exports and policy-based loans. The main empirical findings strongly support that SMEs that receive policy-based loans tend to increase their export volumes. However, these loans' positive impact on exports are only valid for SME exporters with credit scores of 12 or greater (that is, SMEs that have difficulty accessing the external financial market). The estimation results with respect to SMEs' dependence on external financing imply that policy-based loans for SMEs in sectors that are heavily dependent on external finance are effective in that they are instrumental in increasing these firms' exports. These empirical findings emphasize the importance of the external financial market to SME exporters who face various up-front investments that are related to their exporting activities.

Keywords: Policy-based Loans, Export Performance, Intensive Margin, Credit Constraints

JEL Classification: F13, F14

I. Introduction

The Korean government has various types of funded projects to support small- and medium-sized enterprises (SMEs). Among these are policy-based loans (PBL), which are funds that are authorized by a government and loaned out at low interest rates and where the borrower has an obligation of repay the lending government or financial institution.[1] Policy-based loans mainly aim to enhance the competitiveness of SMEs by providing funds to those firms that are having difficulties obtaining financing through the external financial markets, like commercial banks, due to a lack of tangible collateral. According to the purpose of the policy, policy-based funds are classified into purposes such as export promotion, investment in plant and equipment, technology startups, new growth and innovation-related funds, R&D promotion, and new market entry support funds.[2]

In external financial markets where there is no government intervention, market failures due to credit rationing that is related to asymmetric information may result in an insufficient supply of funds for SMEs. Financial institutions that lack credit information on SMEs are more likely to ration credit for fear that increasing the interest rates on these loans may lead to the adverse selection of low-credit SMEs (Stiglitz and Weiss, 1981). With credit rationing, SMEs that lack collateral will not be able to access the funds they need to export their products, even at high rates. In this context, government-based supports in the form of policy-based loans for SMEs can be justified as they reduce these market failures. Thus, the existence of credit rationing can be one of the main rational for financial support policies for SMEs.

To expand into export markets, firms may require to make additional investments but may be unable to do so without access to external financial markets. In this context, access to policy-based funds may allow financially constrained SME exporters to cover their exporting costs and expand their overseas sales. Timely access to policy-based funds can be critical for SMEs that wish to expand their exports, especially for young exporters that lack internal financial resources, and also have difficulties

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[1] Hereafter we employ the term of PBL for the government policy-based loans that come with a repayment obligation.

[2] The Korea Credit Guarantee Fund is the largest PBL provider in Korea; it has policy-based funds that totaled KRW 44 trillion in 2016 and they provided their funds to SMEs for the purposes of export promotion (11 trillion KRW), startups (14 trillion KRW), and new growth and innovation-related funding (13 trillion KRW).

accessing external financing. The difficulties SMEs face in securing financial resources can hinder their potential export activities.[3] In addition, PBLs with the relatively low interest rates may lead to lower costs of production and enhances firms' competitiveness; therefore, the beneficiaries of PBLs are more likely to increase their overseas sales. In this context, it can be expected that policy-based loans will help the export growth of SMEs and, in particular, SME exporters with limited to access for external financial markets.

For SME exporters that lack their own internal financial resources, compared to large-sized firms, the importance of external financing should be discussed so as to emphasize the role of PBLs in shaping SMEs' performance. Figure A1 presents firms' dependence on external financing by firm size (large-size firms and SMEs) and industry. The level of dependence on external financing is calculated as the firm's total borrowings and bonds payable to the value of their total assets (hereafter, we use the term DTA or debt-to-assets ratio). The average dependence on external financing for SMEs in the manufacturing sector is 36 percent, which is almost twice that of large-sized firms. This indicates that external financing is critical for SMEs that want to conduct trade-related business activities. Figure A1 shows that the DTA varies significantly across industries (i.e., KSIC 2-digit major sectors), which suggests that the impact of PBLs on SMEs' performance could differ, depending on the industry. For instance, the effect of receiving a PBL on export performance may be larger for industries with high DTAs and/or for SMEs that have difficultly accessing external financing.

For this study, we conduct a survey of 1,000 Korean SMEs. The survey questions aim to obtain information on the SMEs exports and to identify information on the beneficiaries of policy-based loans. The SMEs that received PBLs were already exporters prior to benefitting from these loans, so our study focuses on these loans' effects on the firms' intensive margin of exports.[4] Given the importance of external finance across sectors and firm-level difficulties in accessing the source of financing, we additionally look into the different impacts of PBLs on export performance based on firms' DTAs, credit ratings. This approach enables us to provide meaningful information

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[3] SMEs that intend to expand their exports should have sufficient resources to cover additional costs, such as research and marketing costs for new markets, costs for the localization of products, costs that correspond to product standardization, and various consulting costs.

[4] The intensive margin of exports is related to the increase in the export volume of the firms, while the extensive margin reflects the firms' entry decision of export markets.

on a desirable direction across SMEs' resource allocations, and the ways in which governments can effectively utilize export-related loans for SMEs' internationalization.

The main empirical findings strongly support that SME exporters that receive PBLs tend to increase their export volumes. However, this positive impact of PBLs on exports is only valid for SME exporters with credit scores of 12 or greater (that is, SMEs having difficulty accessing the external financial market). The estimation results with respect to firms' dependence on external financing imply that providing PBLs to SME exporters in industries that are heavily dependent on external financing would help these firms' increase their exports. These empirical findings emphasize the importance accessing the external financial market for SME exporters that are confronted with various up-front investment costs related to their export activities.

To the best of our knowledge, there has been no noticeable research on the direct link between SME's export-related loans and these firms' export performance, nor has there been any investigation into the heterogeneous impacts of policy-based loans on SMEs' exports. Only a few studies investigated a direct link between export-related loans and export performance. For example, Akgündüz et al. (2018) employed a propensity score matching method to examine the export performance of firms that benefited from subsidized export loans; they found that subsidized Turkish firms increased their exports by 65 percent compared to matched firms in a controlled group. Our study is closely related to Akgündüz et al. (2018) in that both examine a link between policy-based loans and firms' export performance at the intensive margin. However, our paper focuses more on the heterogeneous effects, of PBLs, that may vary across firm-level differences in accessibility to external financing (that is, credit ratings and/or DTAs). By doing so, our paper may contribute to the policy-oriented literature on topics that are associated with how to allocate the resources across SME exporters so as to effectively increase their exports through policy-based loans.

The remainder of this paper proceeds as follows. In the following section we discuss the existing literature on the topic of financial constraints, PBLs and export performance. In Section III we describe the empirical methodology and the data in details. In Section IV, we present and discuss the estimation results. Section V concludes our paper.

II. Literature Review

Numerous studies have examined the relationship between financial constraints and export performance, using firm-level data (Minetti and Zhu, 2011; Manova, 2013;

Egger and Kesina, 2013; Manova et al., 2015; Chaney, 2016; Cheng et al., 2021). Most of these studies confirm that credit constraints are critical for firms' exporting behavior. Findings show that less financially constrained firms self-select into exporting (that is, along the extensive margin), and firms with fewer financial constraints show better export performance (that is, along the intensive margin). For example, Egger and Kesina (2013) employed the Chinese firm-level data to provide the empirical evidence that firms with more financial constraints are less likely to export. Similarly, Cheng et al. (2021) examined the effect of credit rationing on the export performance of SMEs in China; they show that the credit rationing decreases the intensive margin of SMEs' exports by more than 29 percent. These studies show the link between firms' financial constraints (e.g., credit ratings or liquidity ratios) and their export performance. However, they do not directly discuss the impact of policy-based loans on the exports of SMEs that struggle with credit constraints. Our study is more policy-oriented and will help shed light on the relationship between policy-based loans that serve to lower SME exporters' financial constraints and, consequently, their export performance.

OECD (2009) stressed the importance of government-support policies that aim to ease the various types of export constraints SMEs face.[5] In particular, the OECD (2009) emphasized that it is important to improve export competitiveness through efficient funding for SMEs that are having difficulties accessing external financing. The results of our study's survey also indicate that SMEs with little or no access to external financing face major obstacles in their export activities. According to the results of survey questions that asked about difficulties related to exporting, external financing was considered one of the major difficulties in relation to SMEs' exporting activities.[6]

Despite the large number of studies on a link between export support programs and export performance, there have been few studies of the extent to which government

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[5] A large number of studies have evaluated the effects of trade promotion program on trade outcomes (e.g., Volpe Martincus and Carballo, 2008; Cruz, 2014; Van Biesebroeck el al., 2015; Munch and Schaur, 2018). Trade promotion programs in general refer to various activities to help firms overcome obstacles related to exports. These activities related to trade promotion tend to reduce the fixed costs of firms, such as information or marketing expenses. Almost all studies find a positive relationship between firm-level export promotion supports by government and export outcomes.

[6] About 33% of exporting SMEs responding to the survey said that external financing was a difficulty in export-related activities. About 41 percent of those firms responding to the survey answered the lack of information on overseas markets is the biggest challenge related to exports.

policy-based loans affect the export performance of SMEs. In particular, there are no studies that emphasize the importance of credit ratings and the dependence on external financing in determining the effects of PBLs on firms' exports. Only a few studies investigated a link between subsidized credit and export performance (Zia, 2008; Paravisini et al., 2015; Van Biesebroeck et al., 2016; Akgündüz et al., 2018). For instance, Akgündüz et al. (2018) showed that Turkish firms that have subsidized export-loans increased their exports by 65 percent compared to non-subsidized firms. Similarly, Paravisini et al. (2015) used matched customs and firm-level bank credit data from Peru and confirmed that positive effects of bank credit on exports are mainly explained by the intensive margin of exports, but not in the extensive margin.

Zia (2008) also emphasized the role of subsidized credit in shaping firms' export performance. The author used an exogenous shock to the supply of subsidized credit with loan-level data from export sector in Pakistan and confirmed that the removal of subsidized credit leads to a significant decline in exports of private firms, while the exports of large-sized, publicly-owned firms are unaffected. Zia (2008) argued that the export effects of subsidized credit may not be observed because publicly-owned firms are generally free from the financial constraints. Our study differs from previous studies on a link between subsidized loans and firms' export outcomes in that we focused more on the heterogeneous effects, of policy-based loans on SMEs, that may be dependent on the firm-level difference in accessibility to external financing.

III. Empirical Strategy and Data

1. Estimation Method

This study employs both firm-level fixed effects and random effects in a model that is used to examine the impact of government-supported funds (policy-based loans) on SMEs' export performance. In this study, we focus on the effects of policy-based loans on exports at the intensive margin. Therefore, only SMEs that were already exporting before receiving PBLs are included in this analysis. The equation with the fixed-effects model is as follows.[7]

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[7] The potential issues on endogeneity can occur due to a self-selection. For example, SMEs that are more likely to increase their exports tend to be the firms that apply for PBLs. To deal with this concern, we employed difference-in-difference (DID) methodology with a propensity score

$$ln(EX_{it}) = \alpha + \beta PBL_{it} + X'_{it}\gamma + \mu_i + \sigma_t + \varepsilon_{it}, \tag{1}$$

where the subscript i refers to an exporting firm in year t. $ln(EX_{it})$ is the logarithmic transformation of the export value.[8] PBL is a variable of interest that contains information about whether a firm benefits from policy-based loans, and the types of $PBLs$ are as follows: a dummy variable that takes the value of 1 if an SME has received a policy-based loan; the total number of policy-based loans received; and the total amount of these policy-based loans.[9] To be more specific, a dummy variable, PBL_{it} takes the value of one if SME i had received PBLs for the first time in year t. Therefore, we exclude the impacts of PBL financing prior to year t on firms' export performance in year t. X_{it} is firm i's characteristics that vary with the year (that is, the total assets, sales per worker, capital stock per worker, firm age, and the ratio of intermediates to exports).[10] We employ the total assets as a proxy for the measure of firm size.[11] μ_i and σ_t are the firm-level fixed effects and year dummies, respectively.

This study aims to examine the extent to which PBLs affect the export performance of SME exporters, so only 496 Korean SME exporters out of the 1,000 surveyed firms are used for this analysis. Further, SMEs that had received financing from PBLs prior to their first entry into the export market were excluded from the analysis so as to

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matching (PSM), and the main results are basically similar to the ordinary least squares with fixed effects. The results using PSM-DID are available upon request.

[8] It should be noted that there were only 37 SMEs with 'zero' exports at least once during the sample period because we restricted the sample to the SMEs that were already exporters before receiving PBLs. Nevertheless, we replaced the value of exports by the value of exports plus one, allowing the log of the zero values to take a zero value. In fact, the estimation results are similar regardless of whether 'zero' exports are included or not.

[9] It should be noted that, as of 2016, only 10 percent of SMEs that benefit from PBL had received PBL three or more times. For this reason, the estimation results of the PBL effect on exports is expected to be similar regardless the selection of the PBL variables (that is, the dummy or the number of PBLs received).

[10] In addition to those control variables mentioned above, we conducted an analysis that includes additional variables such as operating profit margin, export share of foreign affiliates, dummies for other government-based supports (that is, other financial, technical, tax, human resource, and certification supports).

[11] Total assets and the number of employees are the most popular firm size proxies in empirical work. However, the number of employees, in the KED data used for this study, does not vary by year, so we use total assets as a measure of firm size. See Dang et al. (2018), where the authors point out that the value of total assets is a good proxy for the firm's total resources.

consider the impact of PBLs on the export performance of existing exporters (that is, the PBL effect on exports at the intensive margin).[12]

Furthermore, we examine the heterogeneous impacts of a policy-based loan on exports that may depend on firm- and industry-specific characteristics: i) credit rating, ii) debt-to-total assets ratio, iii) firm size, and iv) firm exporting age. For this purpose, we estimate equation (1) using interaction terms, and the selection of the subgroups depends on the degree of their credit rating, DTA, firm size, and exporting age, among others. The credit rating, DTA, firm age, and exporting age are classified into two subgroups according to their distributions. See the following section for a more-detailed the construction of these subgroups. The additional analyzes with respect to the heterogeneous impacts enable us to suggest useful implications for policy makers regarding the efficiently allocating government resources across SMEs so as to improve the effect of policy-based programs.

2. Data

This study uses survey data, on 1,000 Korean SMEs with 10 or more employees, that is extracted from Korea Enterprise Data (KED). [13] The KED is a leading institution that supplies credit reports on businesses; it was jointly established by policy-based financial institutions that service SMEs (i.e., the Korea Technology Finance Corporation (KIBO), the Korea Development Bank) and other major commercial banks. The KED provides a variety of corporate credit services, including credit ratings on and technical capability assessments of SMEs. The KED maintains a database on about 8 million firms that includes information from these firms' major financial statements and number of employees (that is, total assets, value of capital stock, total sales, and profits, among others) and their business profiles, including their financial histories and credit information. In particular, it provides reliable credit-rating information that can be used as basic data when eligible SMEs are being selected for policy-based loans.

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[12] Since the number of SMEs that became exporters after financing via PBLs is not enough to examine the extensive margin effect of PBLs, this study only focuses on the intensive margin effect.

[13] It should be noted that the survey sample well represents the population of Korean manufacturing SMEs in that the distribution of 1,000 SMEs by employment, sales, and region is similar to that of the entire manufacturing industry. See Figures A2 and A3 in the appendix for a representative sample of the population.

We survey these firms for additional information so as to examine the impact of policy-based loans on these firms' export performance. The main purpose of the survey is to construct export information and to identify information on the beneficiaries of policy-based loans.[14] To be more specific, the survey questionnaire was designed to gather information on the SMEs' exports, beginning with the first year they began exporting and the value of their exports over the past three years. In addition, the variables developed through the survey include the share of intermediates in exports and the major obstacles to exports.

The study's focus is on the extent to which policy-based loans, in the government's overall representative SME-support program, has an effect on SMEs' export performance.[15] As such, the survey questionnaire asked about these SME's policy-based loans in order to identify the number of PBLs granted to SMEs, the total amount of these loans and the first year these SMEs received PBLs.

This study emphasizes the roles of credit ratings, the debt-to-asset ratios (that is, total borrowings and bonds payable to total assets) and other firm-level characteristics in shaping the effects of PBLs on firms' export performance. The KED broadly classifies credit ratings along a scale of 10, ranging from AAA to D, depending on the firm's debt-paying ability. These credit ratings are further subdivided into 22 scales, as those from A to CC are additionally modified by a plus or minus sign to show their relative standings within the major rating categories. It should be noted that firms with a credit rating of one are those with the highest level of debt-paying capacity, while those with a grade 22 rating are considered to be at the lowest level of debt-paying capacity due to a lack of tangible collateral.

In regard to the DTA, this study uses the KSIC 2-digit industry-level categorizations that are available from Statistics Korea's 2016 Financial Statement Analysis (FSA). Figure A1 shows that the DTA for SMEs varies depending upon their KSIC 2-digit industry. It also indicates that these SMEs' DTAs are much higher compared to those

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[14] The survey on "the status of SME exports and the use of policy-based loans" was commissioned by Korea Institute for International Economic Policy and conducted by Gallup Korea.

[15] Government-based PBLs for SMEs are mainly sourced from the Korea Credit Guarantee Fund (KODIT) and the Ministry of SMEs and Startups (MSS). As of 2016, the value of KODIT's capital funds for exporting SMEs were about 11,051 billions, which is about 25 percent of KODIT's total funds. The export-support loans sourced by MSS were valued at about 229 billions, which was much lower than KODIT's available funds. It should be also noted that PBLs in this study refers to all types of policy-based financing, including export-support loans.

of large-size firms. Since a firm's level of dependence on external financing to conduct their business activities may be heterogeneous, depending on the industry, an analysis that uses the industry-level DTA is meaningful.[16] In other words, the heterogeneous effects of PBLs on export performance, depending on the industry-level DTA, can help derive useful policy implications with regards to an effective allocation of SME support funds.

In sum, this study employs i) information on exports and PBLs obtained from the survey data; ii) firm-specific variables (i.e., major financial statements, employment, credit ratings, credit histories, and business profiles) obtained from the KED; and iii) industry-level DTAs from the FSA provided by Statistics Korea. The variable for credit rating uses the SME's four years average (2015-2018), due to the large number of missing observations. It should be also noted that the KED provides all of the related variables that correspond to the 1,000 surveyed SMEs for 2016 and 2017, while these variables are missing for 311 surveyed SMEs for 2018. Thus, we only use the data for 2016 and 2017 because a large number of observations about financial information are missing for 2018.

The heterogeneous effects of PBLs on exports are analyzed by subgroups of the variables of interest, such as the credit rating, DTA, age, region, and firm size. The credit rating and DTA are classified into two subgroups according to their distribution.[17] Dividing the two subgroups according to their credit ratings can be rationalized in that credit rankings are ordinal measures of credit risk (that is, indicators of relative risk), rather than being any absolute measures of actual default rates. Other variables, such as firm age and exporting age, are also classified into two groups, based on their distribution, so the number of observations in each subgroup are similar. The SMEs' regions are classified into two subgroups: Seoul and other regions, based on the survey

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[16] Another reason why we use the industry-level instead of the firm-level DTA is that the firm-level DTA is one of critical components that affects the firm-level credit rating.

[17] The criteria for a credit score are 12th grade (that is, equivalent to the credit score of "B"), so SMEs with a credit score of 12 or less are included in the group that has a relatively low credit constraints, while SMEs with a grade of 12 or more are included in the group that is a relatively high credit constraints. Another reason for dividing credit scores into two subgroups based on a "B" rating is that if the credit score is less than "B", then this indicates firms that are facing various difficulties in the external financial market. In fact, it is a reality that commercial banks focus on firms with credit ratings of "B" or higher. The industry-level DTA is also classified into two subgroups, based on its distribution. See Figures A4 and A5 in the appendix for the distribution of the credit scores and the DTAs.

results. Difficulties in obtaining external financing are the major obstacles to exporting in most regions except for Seoul.

Table 1 summarizes the descriptive statistics for the main variables that are used in the empirical analysis. The samples in Table 1 are restricted to the SMEs that were already exporters before receiving their PBLs to capture the intensive margin of exports.[18] The sample in the final analysis was additionally restricted to the SMEs that had received PBLs for the first time in 2016. In other words, exporting SMEs with a history of receiving PBLs before 2016 were excluded. Table 2 shows the number of SMEs according to export status and financing status. For instance, the total number of SME exporters in 2016 was 496, out of which 102 (20.6 percent) had received financing through PBLs. Firm's exporting age is calculated by using the information on the first year the SME begin to participate in exporting.

Table 1. Descriptive Statistics of the Main Variables

Variables	Obs.	Mean	Std. Dev.	Min	Max
ln (Exports)	927	6.40	2.70	0.00	11.17
Dummy-PBL	933	0.20	0.40	0.00	1.00
Number of PBLs	934	0.33	0.86	0.00	10.00
ln (Amount of PBL)	934	2.42	4.94	0.00	13.12
ln (Sales per worker)	934	12.42	0.78	7.03	14.68
ln (Capital stock per worker)	901	11.62	1.00	6.74	14.99
ln (Total assets)	934	16.00	1.09	12.97	19.17
Number of employees	934	47.24	52.38	10.00	423.00
Intermediates-exports ratio	934	12.71	28.72	0.00	100.00
Firm age	934	16.26	8.61	1.00	61.00
Firm exporting age	904	9.52	7.61	0.00	47.00
Credit-rating scales	904	12.12	3.56	1.00	22.00
Debt-to-assets ratio	934	35.13	5.03	22.42	51.78

Note: The debt-to-assets ratio (DTA) is the total borrowings and bonds payable to the total assets at the industry level.

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[18] Since only 23 SMEs started exporting after receiving PBLs, its effect on the extensive margin of exports is expected to be very limited.

Table 2. The Number of SMEs with Policy-based Loans Across Export Statuses

	PBL (NEVER)		PBL (2016)		PBL (2017)	
	X	O	X	O	X	O
Non-exporting firms	309	195	401	103	396	108
Exporting firms	321	175	394	102	382	114
Total Firms	630	370	795	205	778	222

Notes: PBL (Never) refers to information on whether the SME has received at least one PBL. For instance, the total number of exporting SMEs with financing via PBLs in 2016 was 102.

IV. Empirical Results

Table 3 presents the main results estimated using equation (1). The first three columns are obtained from the fixed-effects model and the results that are estimated using the random effects are shown in the last three columns.[19] The variables of interest regarding policy-based loans are statistically significant at the conventional level. The magnitudes of the coefficients are very similar regardless of the estimation methodology (that is, fixed vs. random effects). The Hausman test, however, indicates that since the p-value is less than 0.05, it is more consistent and appropriate to use the fixed-effects model to estimate equation (1).[20]

As shown in Table 3, the results strongly support that PBLs have a positive effect on the export performance of existing SME exporters. Based on the estimated coefficient of *Dummy-PBL*, for instance, SME exporters that benefited from PBLs tend to export about 74 percent more compared to those exporting SMEs that do not benefit from PBLs.[21] The positive link between the beneficiary status related to PBLs and firms' exports is in line with the recent study by Akgündüz et al. (2018) that employed Turkish firm-level data to show that firms that receive export-related loans

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[19] We check the robustness of our main findings with the inclusion of additional control variables such as export share of foreign affiliates, dummies for other government-based supports (other financial, technical, tax, human resource, and certification supports). The estimation results including additional variables, which is reported in appendix Table A1, are similar to those in Table 3.

[20] In fact, the p-values obtained from the Hausman tests are less than 0.003.

[21] Note that $\exp(\hat{\beta}) = \exp(.556) \approx 1.74$, where $\hat{\beta}$ is the coefficient estimate for the dummy variable of PBL.

are more likely to increase their exports.[22] Similarly, the export performance of SMEs tends to increase with the number of PBLs received and the total value of these PBLs.[23] As expected, the estimation results are similar regardless of the selection of the PBL variables (that is, Dummy-PBL or Number of PBL). This result reflects that about 90 percent of SMEs that benefit from the PBL have received it once or twice, so the Dummy-PBL and Number of PBL are very similar.

Table 3. Main Results: Export Effects of Policy-based Loans

| | Dependent variable: *ln* (Exports) | | | | | |
| | Fixed Effects | | | Random Effects | | |
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy-PBL	0.556** (0.255)			0.544*** (0.203)		
Number of PBL		0.550** (0.250)			0.383*** (0.148)	
ln (Amount of PBL)			0.040* (0.022)			0.041** (0.020)
ln (Sales per worker)	0.633*** (0.148)	0.618*** (0.156)	0.610*** (0.158)	0.282*** (0.101)	0.255** (0.104)	0.252** (0.106)
ln (Capital stocks per worker)	0.167 (0.243)	0.206 (0.238)	0.170 (0.252)	0.076 (0.186)	0.083 (0.188)	0.074 (0.187)
ln (Total assets)	0.207 (0.230)	0.125 (0.232)	0.183 (0.206)	0.917*** (0.136)	0.923*** (0.133)	0.930*** (0.136)
Intermediates-exports ratio	0.131** (0.052)	0.133** (0.052)	0.132** (0.052)	0.010*** (0.003)	0.010*** (0.003)	0.009*** (0.003)
Firm age	0.074 (0.076)	0.081 (0.080)	0.089 (0.084)	-0.001 (0.018)	0.001 (0.018)	-0.002 (0.018)
Observations	761	762	762	761	762	762
R-squared	0.085	0.093	0.081	0.243	0.242	0.242

Notes: KSIC 2-digit industry dummies and year dummies are included in all random-effects models to control for the industry- and year-specific effects. The standard errors are clustered in KSIC 2-digit industry level and given in parentheses. ***, **, and * refer to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

[22] Akgündüz et al. (2018) used the propensity score matching method to show that firms receiving government loans in the treated group increase their exports by about 65 percent compared to the matched firms in the controlled group.

[23] Sales per worker and the ratio of intermediates to exports are positively associated with SMEs' export performance. However, the value of total assets as a proxy for firm size is positively related to SMEs' exports but it is only significant in the random effects model.

Table 4 shows the estimation results, including the interaction terms in equation (1). The variable *Credit Dummy* that takes value of one if the credit score is 12 or less is used as an interaction with the PBL variables so as to capture the different effects of PBLs on export performance, depending on the SME's relative difficulty in obtaining external borrowing, such as through bank financing. It should be noted that the credit dummy with the value one consists of SMEs with a relatively high-level credit rating (that is, financially less-constrained firms).

Table 4. Main Results: Heterogeneous Effects of Policy-based Loans (Credit Rating)

	Dependent variable: *ln* (Exports)					
	Fixed Effects			Random Effects		
	(1)	(2)	(3)	(1)	(2)	(3)
Dummy-PBL	0.977*** (0.356)			0.882*** (0.314)		
× Credit dummy	-1.047* (0.562)			-0.795* (0.473)		
Number of PBL		0.942*** (0.256)			0.713*** (0.215)	
× Credit dummy		-0.837** (0.380)			-0.550** (0.276)	
ln (Amount of PBL)			0.049* (0.030)			0.050* (0.026)
× Credit dummy			-0.021 (0.045)			-0.022 (0.038)
Credit dummy				-0.095 (0.290)	-0.103 (0.290)	-0.152 (0.290)
Observations	736	737	737	736	737	737
R-squared	0.092	0.104	0.079	0.245	0.243	0.246

Notes: KSIC 2-digit industry dummies and year dummies are included in all random-effects models to control for the industry- and, year-specific effects. × *Credit Dummy* refers to the interaction term between the credit dummy and the variables of interest. The other control variables, such as sales per worker, capital stocks per workers, total assets, intermediates export ratio, and age, are included in all model specifications. The results of these control variables are available upon request. The standard errors are in parentheses. ***, **, and * refer to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

As shown in Table 4, the *PBL-dummy* is positive, while its interaction is negative and significant. These results indicate that the effect of PBLs on the intensive margin of exports is positive for SMEs with a credit dummy of value zero, while this positive effect disappears in SMEs with a credit dummy of value one. In other words, export-related loans are effective for SME exporters with relatively low credit ratings, while PBLs have no significant impacts on the export performance of SMEs with credit scores of "B" or greater. This interesting result can be explained by the fact that the marginal effect of PBLs tends to be larger for financially more-constrained exporters because they have few outside options for financing their export-related costs.[24] Similarly, the impact of PBLs on the exports of SMEs tends to increase with the number of PBLs received, and this positive effect almost disappears for SME exporters with relatively high credit ratings.

In addition, we look into the different impacts of PBLs on the intensive margin of exports that depending on firm-specific characteristics, such as the credit rating, firm age, firm's exporting age, region, the number of employees. We take account of the distribution of each variable so as to construct the two sub-groups.[25] The results obtained from the fixed-effects model as the preferred specification are shown in the Table 5.[26] For the subgroup with a credit score of 12 or greater that consists of SMEs having difficulty in accessing external financing due to high credit constraints, the SME exporters that benefit from PBLs substantially increase their exports. In contrast, the PBL effect on exports does not exist at the conventional level of significance in the case of the financially healthier SMEs with credit scores of 12 or less. These results are in line with the findings shown in Table 4. It should be noted that the results are similar regardless of the criteria of dividing SMEs into two subgroups according to credit scores (that is, around credit scores of 12). The results obtained from the estimation using different criteria of credit ratings are shown in appendix Table A3.

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[24] In fact, commercial loans provided from external financial markets are heavily concentrated on firms with a credit rating of "B" or higher.

[25] It should be noted that the results from a pooled sample with interaction terms between the PBL-dummy and interesting variables (that is, exporting age, region or the number of employees) were insignificant at conventional levels. For this reason, we construct the two sub-groups according to the distribution of each variable.

[26] The estimation results using the random effects model are shown in the appendix table A2. Note that the results are similar to those from the fixed-effects model.

As regards firm age, the PBL effects are statistically insignificant regardless of the subgroups being classified by firm age. However, the benefits of receiving PBLs is that they tend to considerably increase the exports of the SMEs with relatively short exporting histories, while its effect is statistically insignificant for SMEs with relatively long exporting experiences. [27] These results are interesting as they imply that government-based export-related loans are effective for expanding the exports of SMEs that are relatively young exporters. This means that, for SMEs with relatively short exporting experiences, it is important to secure sufficient financial resources to cover export-related costs to improve their export performance.

We divide the region into two sub-regions (that is, Seoul and other areas), according to the survey results. The survey results indicate that difficulties in external financing are the major obstacles to exports for firms in most regions except for Seoul. As shown in Table 5, the PBL effect on exports does not exist for SMEs in the Seoul area, while its effect is positive and significant for other regions. These results emphasize the importance of policy-based loans, throughout government, in terms of providing ease of access to external financing for exporting SMEs.

The last two columns in Table 5 show that the impact of PBLs on the intensive margin of exports does not exist in the group that consists of SMEs with 50 or less employees, while its effect is statistically significant in the group of relatively large-size SMEs. These results do not imply that the PBL effect on exports is strengthened as the size of the firm increases. However, the results obtained from a sub-sample analysis at least statistically guarantee that PBLs do not lead to a positive effect on exports of relatively small-size SMEs (that is, firms with fewer than 50 employees). In this context, the non-financial government supports such as overseas marketing, overseas standard certification and e-commerce supports other than PBLs may be desirable to improve export performance of SMEs with relatively small size.

Table 6 presents the estimated results of our analysis of PBLs' heterogeneous impact on exports, depending on the SME's industry-level dependence on external financing. We employ total borrowings and bonds payable to total assets (DTA) as a proxy for the dependence on external financing. We analyze these two subgroups according to the distribution of their DTAs and the number of observations in each

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[27] It should be noted that these results are robust around 8 years that is the criteria of exporting ages for dividing subgroups.

subgroup.[28] The first two columns in Table 6 show that the coefficient of the PBL dummy is significantly positive only in the second subgroup that consists of sectors that heavily depend on external financing (that is, DTAs >35). In other words, this result implies that a policy-based loan is effective for the export performance of SMEs in sectors where there is a heavy dependence on external financing.

Table 5. Main Results (Fixed Effects) - Subgroup Analysis

	Dependent variable: ln (Exports)									
	Credit rating		Firm age		Firm exporting age		Region		No. of Employees	
	≤ 12	> 12	≤ 15	> 15	≤ 8	> 8	Others	Seoul	≤ 50	> 50
Dummy-PBL	-0.090	0.919**	0.579	0.553	1.016**	0.063	0.576**	-0.547	0.389	1.095**
	(0.423)	(0.399)	(0.425)	(0.401)	(0.498)	(0.229)	(0.267)	(2.218)	(0.354)	(0.466)
ln (Sales per worker)	0.972***	0.483	0.878**	0.171	0.728	0.508**	0.769***	0.641	0.647*	0.301
	(0.364)	(0.421)	(0.435)	(0.400)	(0.499)	(0.207)	(0.270)	(1.076)	(0.355)	(0.384)
ln (Capital stock per worker)	0.076	0.179	0.527	-0.142	0.298	-0.020	0.219	-0.539	0.338	-0.031
	(0.393)	(0.247)	(0.321)	(0.234)	(0.363)	(0.139)	(0.182)	(1.116)	(0.281)	(0.215)
ln (Total assets)	0.277	0.192	-0.076	0.442	0.160	-0.051	0.096	1.181	0.225	0.246
	(0.539)	(0.554)	(0.567)	(0.525)	(0.623)	(0.348)	(0.377)	(1.607)	(0.501)	(0.511)
Intermediates-exports ratio	0.438***	0.093**	0.081*	0.496***	0.451***	0.084***	0.370***	-0.004	0.167***	-0.039
	(0.088)	(0.044)	(0.042)	(0.093)	(0.123)	(0.020)	(0.053)	(0.068)	(0.044)	(0.059)
Firm age	0.016	0.100	0.172	-0.022	0.206	-0.040	0.069	0.043	0.064	0.089
	(0.093)	(0.128)	(0.132)	(0.093)	(0.148)	(0.057)	(0.075)	(0.317)	(0.103)	(0.102)
Observations	411	350	361	400	400	361	672	89	524	237
R-squared	0.148	0.098	0.134	0.149	0.134	0.163	0.182	0.028	0.108	0.084

Notes: The estimator is the fixed effects model. The standard errors are in parentheses. ***, **, and * refer to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

The last two columns in Table 6 show that the PBL effect on exports exists only for SMEs with relatively high credit scores in sectors that are heavily dependent on external financing. In other words, the estimated results in Table 6 emphasize the role of both the DTA and the credit ratings in determining the impact of PBLs on SME's intensive margin of exports. It should be noted that the coefficients of both the PBL

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[28] Note that the mean values of the DTAs are about 35.

dummy and the interaction term are not statistically significant for SMEs that are in sectors whose firms have a relatively low dependence on external financing. In sum, the results shown in the last two columns can be interpreted that the PBL effects on exports valid only in the case of SMEs with relatively low credits in industries that are heavily dependent on external financing.

Table 6. Main Results - Heterogeneous Effect of Policy-based Loans
(DTA & Credit Rating)

	Dependent variable: *ln* (Exports)			
	DTA		DTA	
	≤ 35	> 35	≤ 35	> 35
Dummy-PBL	0.277	0.839*	0.515	1.402**
	(0.392)	(0.430)	(0.468)	(0.564)
× Credit dummy			-0.615	-1.359*
			(0.754)	(0.804)
ln (Sales per worker)	0.548	0.721	0.826**	0.663
	(0.338)	(0.475)	(0.320)	(0.482)
ln (Capital stock per worker)	0.281	-0.011	0.314	-0.016
	(0.231)	(0.353)	(0.227)	(0.365)
ln (Total asset)	0.384	-0.554	0.286	-0.474
	(0.430)	(0.844)	(0.405)	(0.874)
Intermediates-exports ratio	0.138***	0.122	0.086**	0.122
	(0.040)	(0.084)	(0.038)	(0.085)
Firm age	0.111	0.020	0.071	0.024
	(0.099)	(0.129)	(0.094)	(0.131)
Observations	461	300	442	294
R-squared	0.120	0.059	0.127	0.075

Notes: The estimator is the fixed effects model. DTA is the total borrowings and bonds payable to total assets at the industry level. × *Credit Dummy* refers to the interaction term between the credit dummy and the variables of interest. The standard errors are in parentheses. ***, **, and * refer to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

V. Concluding Remarks

This study examines the extent to which a policy-based loan for SMEs affects their export performance. We conducted a survey of 1,000 SMEs that matches with firm-level financial statements. We only focused on SMEs that were existing exporters, so this study is related to the intensive margin of exports. Given the importance of the

dependence on external financing across sectors and the difficulties in accessing external financing at the firm level, we additionally investigated the heterogeneous impacts of PBLs on firms' export performance depending on their debt-to-assets ratios, credit ratings, exporting age, regions, and number of employees.

The main empirical results strongly support assumption that SME exporters that receive PBLs tend to increase their exports. The positive link between PBLs and export performance holds regardless of the type of PBL variable (that is, the PBL dummy, the number of PBLs received, the amount of the PBL). However, PBL's positive impact on exports only holds for SME exporters with credit scores of 12 or greater (SMEs that have difficulties accessing the external financial market). In addition, PBLs tend to significantly increase the exports of relatively young SME exporters, while their effects are not significant for SMEs with relatively long export histories. With regard to firm size in terms of the number of employees, that PBLs only have a positive impact on the intensive margin of exports only applies to the subgroup of SMEs that consists of relatively large-sized firms.

The estimation results with respect to the heterogeneous effects of PBLs, indicates that PBLs improve the export performance of SMEs in sectors that are heavily dependent on external financing. However, this positive effect diminishes in SMEs with a credit dummy of value one. In other words, PBL's positive effects on exports disappear for financially healthier SMEs. To be more specific, the PBL effect on exports exists only for SMEs with relatively high credit constraints in sectors that are heavily dependent on external financing. These results stress the fact that the positive impact of PBLs, that are provided to industries that are heavily dependent on external financing, on exports is more effective for SME exporters with a high credit constraint.

This study focuses on the intensive margin of exports as a positive impact of PBLs. However, due to data limitations, it does not discuss the probability of exporting as a result of receiving PBLs (that is, along the extensive margin). Given the fact that financially less-constrained firms are more likely to be exporters (e.g., Greenaway et al., 2007; Muûls, 2008; Manole and Spatareanu, 2010; Minetti and Zhu, 2011), it would be worthwhile for future studies to include the extensive margin of exports as well as the intensive margin in an examination of the benefits of policy-based loans.

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APPENDIX

Figure A1. Total Borrowings and Bonds Payable to Total Assets
across KSIC 2-digit Industries
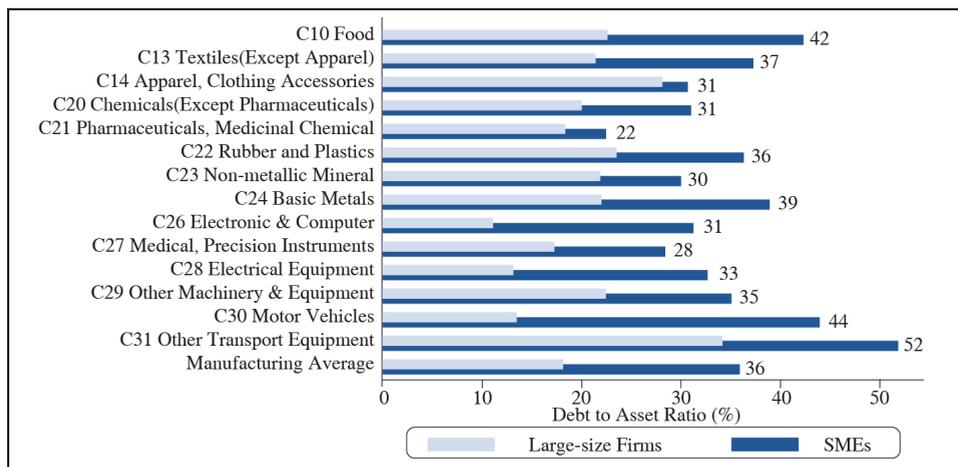
Source: 2016 Financial Statement Analysis (FSA), Statistics Korea

Figure A2. Comparison 1,000 Surveyed SMEs with Korean Manufacturing SMEs
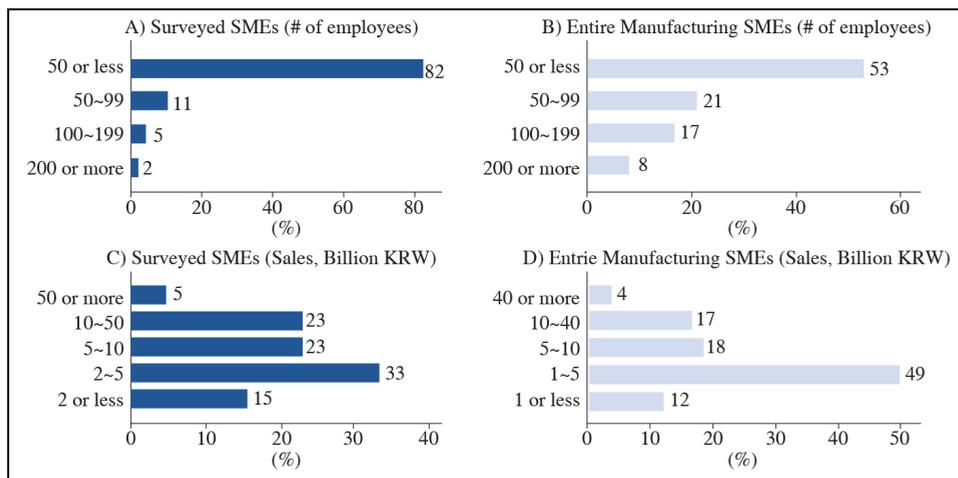
Notes: The survey respondents' sales and employees are based on 2018 and 2019 respectively. The number
of SMEs in the Korean manufacturing industry is based on Mining and Manufacturing Survey data
in 2017 from Statistics Korea.

Figure A3. Comparison 1,000 Surveyed SMEs with Korean Manufacturing SMEs (Region)
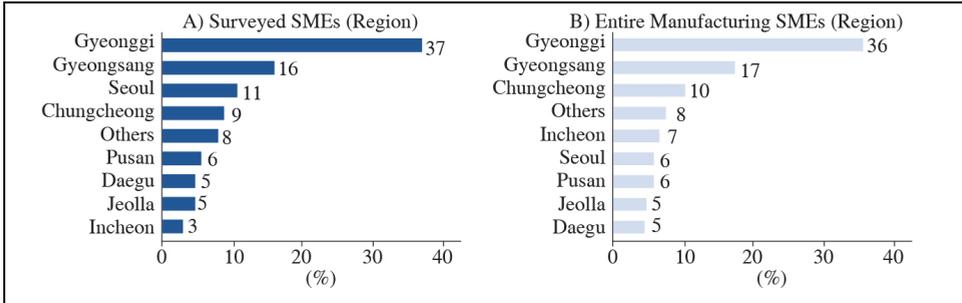
Notes: Ulsan, Daejeon, Sejong, Kangwon, Jeju are classified into Others. The total number of SMEs in the Korean manufacturing industry is based on Mining and Manufacturing Survey data in 2017 from Statistics Korea.

Figure A4. Kernel Density Estimation for Credit Rating
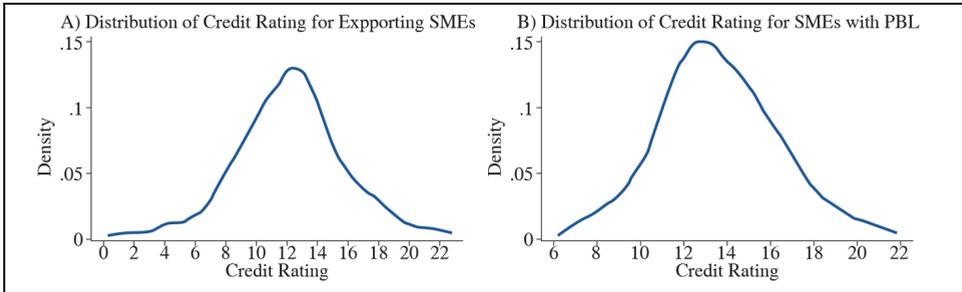
Note: The credit rating is from KED and the survey data, and its scales from 1 to 22.

Figure A5. Kernel Density Estimation for DTA (Analyzed SMEs only)
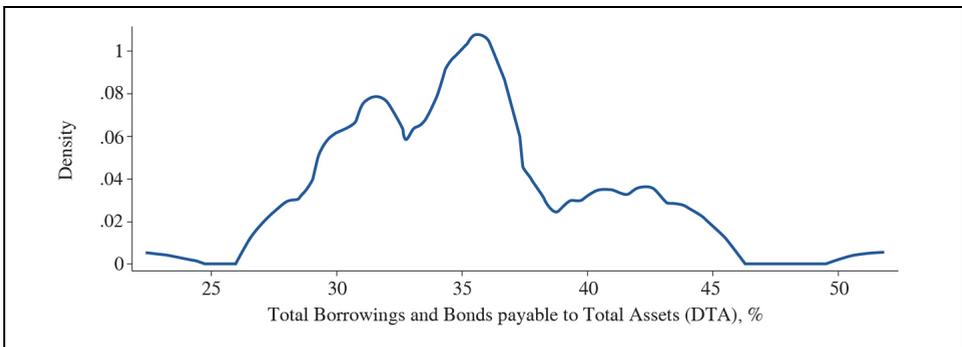
Note: The DTA data is sourced from Financial Statement Analysis (FSA) in Statistics Korea.

Table A1. Main Results with Fixed Effects using Additional Independent Variables

	Dependent variable: *ln* (Exports)		
	(1)	(2)	(3)
Dummy-PBL	0.555* (0.293)		
Number of PBL		0.558*** (0.202)	
ln (Amount of PBL)			0.040* (0.024)
ln (Sales per worker)	0.644** (0.296)	0.631** (0.298)	0.621** (0.300)
ln (Capital stocks per worker)	0.183 (0.194)	0.220 (0.196)	0.186 (0.197)
ln (Total assets)	0.160 (0.391)	0.080 (0.394)	0.135 (0.396)
Intermediates-exports ratio	0.144*** (0.037)	0.145*** (0.038)	0.144*** (0.038)
Firm age	0.061 (0.079)	0.068 (0.079)	0.077 (0.080)
Operating profit margin	-0.099 (0.140)	-0.100 (0.141)	-0.099 (0.142)
Export share of foreign affiliates	0.066 (0.045)	0.066 (0.046)	0.066 (0.046)
Dummy-Other financial supports	0.572 (0.377)	0.561 (0.379)	0.565 (0.382)
Dummy-technical supports	-0.222 (0.471)	-0.321 (0.477)	-0.207 (0.477)
Dummy-tax supports	-0.356 (0.843)	-0.356 (0.848)	-0.359 (0.854)
Dummy-human resource supports	0.490 (0.567)	0.438 (0.570)	0.503 (0.574)
Dummy-certification supports	-0.330 (0.328)	-0.338 (0.330)	-0.333 (0.332)
Observations	758	759	759
R-squared	0.102	0.109	0.098

Notes: Operating profit margin refers to the ratio of operating profit to total sales. Export share of foreign affiliates is the share of exports to foreign affiliates over total exports. Other financial supports are government policies such as subsidies that are not obligated to repay or participation in national R&D projects. The remaining dummies used in the analysis are technical, tax, human resources, and certification supports provided by government. The standard errors are in parentheses. ***, **, and * refer to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A2. Main Result (Random Effects) - Subgroup Analysis

| | Credit rating | | Firm age | | Exporting age | | Region | | Firm size | |
| | Dependent variable: *ln* (Exports) | | | | | | | | | |
	≤12	>12	≤15	>15	≤8	>8	Others	Seoul	≤50	>50
Dummy-PBL	-0.109	0.974***	0.843**	0.448	1.088***	0.029	0.500**	1.572	0.494*	1.111**
	(0.381)	(0.310)	(0.339)	(0.357)	(0.386)	(0.221)	(0.239)	(1.313)	(0.286)	(0.453)
ln (Sales per worker)	0.058	0.580***	0.510**	0.005	0.342	0.349**	0.321*	0.558	0.514**	-0.178
	(0.266)	(0.223)	(0.234)	(0.245)	(0.257)	(0.170)	(0.183)	(0.582)	(0.202)	(0.318)
ln (Capital stock per worker)	0.061	0.049	0.284	-0.176	0.336	-0.106	-0.028	0.946*	0.204	-0.031
	(0.259)	(0.154)	(0.197)	(0.161)	(0.205)	(0.116)	(0.130)	(0.504)	(0.170)	(0.188)
ln (Total assets)	0.013*	-0.002	0.010	0.010*	0.014*	0.007	0.012**	-0.001	0.006	0.014
	(0.007)	(0.006)	(0.008)	(0.006)	(0.008)	(0.005)	(0.005)	(0.017)	(0.006)	(0.009)
Intermediates-exports ratio	1.293***	0.447**	0.864***	1.072***	0.952***	0.573***	0.977***	-0.085	0.654***	1.025***
	(0.218)	(0.212)	(0.232)	(0.187)	(0.221)	(0.166)	(0.152)	(0.628)	(0.231)	(0.332)
Firm age	-0.035	0.052**	0.070	-0.034	-0.039	0.017	0.005	-0.028	0.005	-0.009
	(0.023)	(0.026)	(0.051)	(0.027)	(0.024)	(0.023)	(0.017)	(0.076)	(0.022)	(0.027)
Observations	411	325	361	400	400	361	672	89	524	237
R-squared	0.302	0.304	0.292	0.271	0.312	0.203	0.268	0.370	0.205	0.340
Year Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry Dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: KSIC 2-digit industry dummies and year dummies are included in random effect model to control for industry-, year-specific effects. The standard errors are in parentheses. ***, **, and * refer to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A3. Main Results with Different Criteria of Credit Ratings

	Credit Rating					
	≤ 11	> 11	≤ 12	> 12	≤ 13	> 13
Dummy-PBL	-0.003	0.772**	-0.090	0.919**	-0.048	0.990**
	(0.542)	(0.348)	(0.423)	(0.399)	(0.424)	(0.410)
ln (Sales per worker)	1.285***	0.357	0.972***	0.483	0.883**	0.456
	(0.429)	(0.374)	(0.364)	(0.421)	(0.377)	(0.427)
ln (Capital stock per worker)	-0.126	0.194	0.076	0.179	0.208	0.120
	(0.475)	(0.228)	(0.393)	(0.247)	(0.412)	(0.247)
ln (Total assets)	-0.207	0.308	0.277	0.192	0.044	0.357
	(0.645)	(0.493)	(0.539)	(0.554)	(0.549)	(0.567)
Intermediates-exports ratio	0.353***	0.111***	0.438***	0.093**	0.215***	0.118***
	(0.097)	(0.041)	(0.088)	(0.044)	(0.076)	(0.045)
Firm age	0.110	0.053	0.016	0.100	0.055	0.070
	(0.112)	(0.107)	(0.093)	(0.128)	(0.095)	(0.134)
Observations	317	444	411	350	439	322
R-squared	0.143	0.087	0.148	0.098	0.074	0.120

Notes: The standard errors are in parentheses. ***, **, and * refer to statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.