

# The Effect of Public Export Credit Supports on Firm Performance

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## Abstract

Many countries allocate public funds to export credit service—export insurance and loan services. This paper examines the effects of public export credit supports on firms' global and domestic performance. This study differs from previous studies in that (i) it considers both export loan and insurance from export credit agencies (ECAs) (ii) in a developing country, and (iii) investigates heterogeneous effects by support types and firm characteristics. To construct unique firm-level panel data, this study combines data from two independent ECAs in Korea, each providing export loans and insurance. This paper finds that the effect of financial aids is significant and, more importantly, heterogeneous across support types and firm characteristics—export experience and financial status. The results can be a good reference for developing countries that have more incentives than developed countries to establish or expand ECAs given their weaker financial systems.

Keywords: Export credit support, firm performance, exports

JEL classification: F13, F14, L25

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# 1 Introduction

In terms of exporting, having a competitive product is only half the battle. Exporting requires additional trade financial services for firms to pay for resources to fulfill an order, fill a gap between the time of trade and payment, and protect them against risk of financial default by business partners. To alleviate financial strain and facilitate exports of domestic firms, many countries have export credit agencies (ECAs). Using public funds from the governments, ECAs provide public export insurance and loan services for domestic firms. The public supports are expected to reduce uncertainties that exporters face, compensate for market deficiencies, and improve the exporters' competitiveness. Given the considerable funds by the governments for the supports, key policy questions on ECAs would be whether the financial supports from the public agencies promote exports and local economy, and if they do, how.

There are some studies that examine the effect of export credit supports using aggregated industry-level data (Egger and Url, 2006; Felbermayr and Yalcin, 2013; Janda et al., 2013; Moser et al., 2008). They find a positive relation between export insurance and exports. However, given that it is a firm who receives the support, not an industry, the aggregated data analysis is limited in dealing with the non-random sampling issue. In order to solve the identification problem, recent studies use more disaggregated data and control observable firm characteristics (Felbermayr et al., 2012; Badinger and Url, 2013; Agarwal et al., 2019; Heiland and Yalcin, 2021). The firm-level studies in developed countries demonstrate that firms receiving public export insurance show faster increases in their exports, sales, and employment relative to others.<sup>1</sup> The positive effects are greater in small firms (Agarwal et al., 2019; Heiland and Yalcin, 2021) and during the period of financial crisis (Felbermayr et al., 2012).

Although the previous studies show the empirical evidence of the beneficial effects of the export credit support, there are still some limitations in these studies. First, the results of previous studies may not paint an accurate picture of the entire role of ECAs in the export credit support. ECAs typically provide loans in combination with export insurance.<sup>2</sup> However, the previous studies investigated only export insurance as means of support due to

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<sup>1</sup>Germany (Felbermayr et al., 2012; Heiland and Yalcin, 2021), Austria (Badinger and Url, 2013), and Sweden (Agarwal et al., 2019).

<sup>2</sup>In Germany, Euler Hermes provides export insurance and guarantees, and PwC provides united export loan supports (Felbermayr et al., 2012; Heiland and Yalcin, 2021). In Austria, Oesterreichische Kontrollbank (OeKB) is responsible for both export insurance and loans (Badinger and Url, 2013). In Sweden, EKN provides export insurance services and SEK finances Swedish exports (Agarwal et al., 2019).

data limitations. The main challenge is that the credit services are provided from different independent departments in the countries,<sup>3</sup> which makes it difficult to collect the data and simultaneously examine both types of support. Second, heterogeneous effects of public export financial support have not been thoroughly investigated. Understanding the heterogeneous effects across support types and firm characteristics will be the first step in investigating the optimal combination or allocation of the ECAs' supports to maximize the overall effect of the financial aid. Our analysis makes policy contributions that suggest ways to use limited public funds more effectively. Further analysis may also shed light on the mechanism of the beneficial effects of the public export credit supports on firm performance. Lastly, the previous studies are silent about the effectiveness of ECAs in developing countries. However, recently, interest in the effect of export credit supports in developing country settings has been growing as the level of ECA activities from the countries becomes considerable.<sup>4</sup> In general, firms in developing countries have fewer opportunities to use private export finance services than those of developed countries, since developing countries rarely have well-functioning trade financial systems. Therefore, developing countries have more incentives to establish or expand ECAs than developed countries given their weak financial systems. In addition, as firms from developing countries enter global markets, the demand for ECA in those countries increases.

Filling these gaps, this study examines heterogeneous effects of both export credit services on firms in a developing country.<sup>5</sup> First, we construct unique firm-level data from three distinct data sources to examine the whole effect of public export credit services. We merge the data from two independent ECAs in Korea: one that provides export insurance and other that specializes in export loan services. We then combine the ECAs' datasets with Korean firm data from Statistics Korea. The merged firm-level data can identify which firm receives which types of supports and when. The unique data allow us to investigate the impact of the export credit services on firms' export activity as well as their domestic performance—employment, capital, sales, and value-added per worker. In addition, we use the rich data on firm characteristics to control potential issues in selecting firms eligible for the export credit support. Second, beyond estimating the average effect of the supports from ECAs, we investigate the heterogeneous effects in terms of the support types. The roles

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<sup>3</sup>Czech Republic, Finland, Germany, Hungary, Italy, Japan, Korea, Norway, Poland, and Sweden.

<sup>4</sup>According to the World Bank, the commitment of public-backed ECAs equals 40% of the commitment of private creditors in developing countries (World bank, 2002).

<sup>5</sup>In 2021, the United Nation Conference on Trade and Development moved South Korea to the group of developed economies from Asian and African countries. This paper uses Korean data when Korea was still classified as the group of Asian and African countries.

of export insurance and loans may differ in that insurance can reduce trade risks faced by exporters, whereas loans can relieve their financial constraints. Given that mechanisms of two export credit services for facilitating firm performance may differ, we further estimate the heterogeneous impact of export insurance and loans on firm performance. We also examine who benefits the most from the support by taking into account the firm characteristics—export experience and financial status. We consider the previous export experience of firms motivated by the fact that new exporters tend to face more barriers to international trade than incumbent exporters (Eaton et al., 2014; Kohn et al., 2016). In addition, we examine whether support for firms with large financial constraints is more effective, considering the importance of financial resources in a firm’s exports (Chaney, 2016; Paravisini et al., 2015; Niepmann and Schmidt-Eisenlohr, 2017). This further analysis would shed light on how public export financial support has a beneficial effect on firm performance.

Using the Korean firm-level data from 2006 to 2015, this paper answers whether a firm that receives public export credit services from ECAs shows higher growth in performance relative to other firms. In our estimation, we use the difference-in-difference method and propensity score matching in order to address the selection bias in the supports of the ECAs. We find that the ECAs have significant positive effects on firm exports, employment, capital formation, and sales but not labor productivity. The estimates on firm performance show that the higher growth of treated firms’ output is from the higher growth in inputs rather than productivity. Additional estimates show that the higher export growth is largely attributed to the export insurance, while the higher output growth is from the export loan service. Insured firms may take more risks and expand sales by entering new markets, while firms with loans may invest capital or labour to fill orders. Moreover, we investigate in which firms the support is more effective by considering firms’ prior export experience and financial status. Our analyses demonstrate that the export credit support has stronger beneficial effects on the exports of firms without prior export experience, while the effects on domestic performance are much larger in firms with export experience. Lastly, we find that the ECAs’ supports are more effective for firms with financial constraints relative to less constrained firms. These results suggest that the effect of public export credit services will be greater in countries with less experience in the global market and with weaker financial systems.

The paper is organized as follows. Section 2 introduces export credit agencies. Section 3 describes the data and the empirical strategy. Section 4 presents the estimation results. Section 5 shows the heterogeneous effects of export credit services on firms, and Section 6 concludes.

## 2 Export Credit Agency

Many governments in both developed and developing countries have ECAs to promote domestic firms' exports.<sup>6</sup> The agencies provide support in the form of either export insurance or loan services. The export insurance can cover the political and commercial risks faced by exporters, while the export loan can alleviate financing constraints, that inevitably arise in the middle of the trade cycle, in purchasing inputs for the final goods. The public ECAs, specifically, provide export credit for export transactions not covered by private financial institutions. In other words, ECAs are guarantors or lenders of last resort to mitigate market failure and imperfections when private-sector financing is not available.

ECAs are bound by the World Trade Organization (WTO) Agreement on Subsidies and Countervailing Measures, and the Organisation for Economic Co-operation and Development (OECD) Arrangement on Officially Supported Export Credit. The WTO agreement regulates the use of subsidies and describes countervailing measures, and the OECD arrangement lays out the rules on interest provisions.<sup>7</sup>

Figure 1 shows the volume and the ratio of export credit insurance provided by public ECAs in the world. According to the Berne Union Yearbook 2016, the average volume of new export business from 2012 to 2016 was USD 976 billion. On average, export insurance from public ECAs covers approximately 5.4% of world exports. Considering that ECAs provide both export insurance and loan services, the volume of export credit support can be larger if the export loan is also considered.

South Korea is one of the countries in which public ECAs are active.<sup>8</sup> There are two ECAs, the Export-Import Bank of Korea (EXIM) and Korea Trade Insurance Corporation (K-SURE), which are independent government agencies in South Korea. They both provide public export credit services, but they offer different types of support. EXIM focuses on a trade loan service, while K-SURE provides trade insurance. The South Korean government established EXIM in 1976 to promote national exports. It provides trade loan, guarantee, and forfeiting services, but mainly offers trade loans.<sup>9</sup> In particular, it provides long-term

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<sup>6</sup>By 2021, 34 of the 38 OECD countries (Australia, Austria, Belgium, Canada, Colombia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States) and some non-OECD countries (Brazil, China, and India) have official ECAs.

<sup>7</sup>Commercial interest rates.

<sup>8</sup>According to OECD export credit statistics, the average amount of official export credit provided by Korea from 2009 to 2019 was USD 6.99 billion, ranking third among OECD countries. <https://www.oecd.org/trade/topics/export-credits/statistics/>.

<sup>9</sup>Among firms receiving export financial services from EXIM, around 90% of them receive loan supports

fixed-rate loans that cannot be handled by private financial institutions. Our data show that from 2003 to 2016, an average of 1,231 exporters per year received trade financial services from EXIM.

In 1992, the South Korean government established K-SURE and redistributed the trade insurance business from EXIM. K-SURE provides trade insurance and credit guarantee programs. Its export support services include short- and long-term export insurance and export guarantee services. The average amount of trade insurance undertaken by K-SURE from 2003 to 2016 was USD 103 billion (KRW 115 trillion), of which 81% was short-term export insurance.

Most firms in Korea are well aware of the public export credit services because the ECAs actively promote their services.<sup>10</sup> To receive export credit support from the ECAs, a firm should apply for the EXIM or K-SURE support programs. Although the two ECAs provide distinct types of support, their application processes are similar. Only a firm that has signed an export contract can apply for the export credit support program of EXIM or K-SURE. For the export loan service, a firm has to visit or call the EXIM office for loan advice. During loan consultation, EXIM confirms the firm's financial repayment, export confirmation documents, export contracts, and so on. EXIM determines the preconditions for support by considering the credit rating of the firm and the terms of export contract. If the application is approved, EXIM closes a contract with the firm and provides the interest-only loan. For the export insurance service, a firm should conduct an insurance consultation by phone with a K-SURE representative. After consulting, K-SURE conducts a credit check on importers and exporters, and reviews the application. If approved, K-SURE issues the insurance and the firm pays the insurance premium for the service.

### 3 Data and Estimation

In this section, we explain how we merge the firm-level data from three different data sources and present descriptive statistics of the data. We then discuss estimation issues and describe our empirical strategy for analyzing the effects of public export credit support on firms. Finally, we explain how we set up dependent and independent variables for our estimations.

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and the others receive export guarantees and forfeiting services.

<sup>10</sup>This may alleviate the bias issue associated with a firm's choices of applying for public export credit support.

### 3.1 Data

We combine three distinct firm-level datasets to examine the impact of public export credit services on firm export and domestic performance. The first data are from the Survey of Business Activities (SBA) from Statistics Korea for the period 2006 to 2015. Since 2006, Statistics Korea has collected annual survey data for all firms with 50 or more workers and KRW 300 million or more in sales every year.<sup>11</sup> The data include detailed input, output, and trade information about the firms. Two additional datasets, K-SURE and EXIM, are used to identify firms receiving export credit supports. The ECAs' data contain IDs and years of supported firms from 2003 to 2016. Using the Korean ECAs' data, we can identify which firms received the export credit supports, when, and where. We match the ECAs data to the SBA data using the firm ID, and obtain unbalanced panel data over the period 2006–2015.

Our combined data have several positive features. First, the firm-level datasets from the ECAs are novel enough to analyze the whole effects of public export credit support, given that ECAs provide loan as well as insurance to exporters. Second, the comprehensive data on firms from the SBA allow us to control the firm characteristics that can influence the selection of the export credit support as well as the outcomes of interest. Third, the merged data make it possible to investigate the heterogeneous effects in terms of the support types and the firm characteristics beyond the average effect of ECAs. Lastly, estimation results using the data can be a good reference to examine the effectiveness of ECAs in developing countries that have more incentive to establish or extend government-backed ECAs, given their weaker financial systems relative to developed countries.

Table 1 shows descriptive statistics for the number of manufacturing firms in SBA. The sample of this paper is limited to manufacturing firms, since there are several other supports and regulations from the Korean government to service sectors. In order to accurately identify the impact of the export credit supports, we need to use additional data to control other policies on the service firms.<sup>12</sup> There is an average of 5,734 manufacturing firms per year from 2006 to 2015 in Korea. Of these, 3,595 firms performed exports and approximately 24%

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<sup>11</sup>A sample selection bias issue occurs when we use SBA data, since it includes relatively large firms. However, the selection bias can be alleviated, since our samples are limited to exporters whose size is larger than non-exporters in general. Furthermore, in order to check the bias issue, we merged the ECAs data with the Mining and Manufacturing Survey (MMS) which includes all establishments with more than 5 workers in Korea's mining and manufacturing sector. In 2007, the number of manufacturing exporters receiving export credit services from EXIM is 591 with MMS, while it is 587 with SBA. This shows that the supported group may not be very different even if small exporters with 5 -50 workers and sales of less than KRW 300 million are included.

<sup>12</sup>According to the our data, around 93% of supported firms are manufacturing firms and only 7% of them are service firms.



of the exporters<sup>13</sup> received the export credit services from the ECAs. On average, out of 868 supported manufacturing exporters, 323 firms received the export insurance from K-SURE, 681 firms received the export loan from EXIM, and 136 firms received both services.

## 3.2 Methodology

In order to properly identify the casual effect of export credit supports on firms, we need to consider potential endogenous issues on selection of firms for the export credit supports.<sup>14</sup> The selection for the support may not be random and can be correlated with firm characteristics. A non-random selection can result in biased estimates. For example, if productive firms are more likely to receive the services from ECAs and the current firm characteristics affect their future outcomes, this would overestimate the effect. Another challenge for rigorous estimations is to construct a proper control group for the missing counterfactual. An unbiased estimate of the counterparts is necessary to accurately capture the effect.

To mitigate the selection issue and set a valid control group, we apply a difference-in-difference estimator combined with a propensity score matching that relies on observable firm characteristics (Heckman et al., 1997; Rosenbaum and Rubin, 1983). In our estimation, supported firms in the treatment group ( $T$ ) receive the export credit services in year  $t$  but not in year  $t-1$ . Non-supported firms do not receive any services from the ECAs in both  $t-1$  and  $t$  years. Among the non-supported firms, we choose a firm for matching with the supported firm based on observable firm characteristics. We use the propensity score method, which measures the propensity for a firm to receive the export credit service given a set of observable firm characteristics. We calculate the conditional probability based on the rich firm characteristics, industry, and year by using a probit model. With the predicted score from the same year, we match a treated firm with the nearest neighbour control firm ( $C$ ).

In our estimation, we compare the change from before to after outcome ( $Y$ ) of supported firms ( $T$ ) to that of matched non-supported firms ( $C$ ). We then calculate the average treatment effect of the treated, defined as  $E[\Delta Y^T - \Delta Y^C | D = 1]$ , where  $D$  is an indicator of the treatment. The difference within the firm removes systematic differences from unobserved time-invariant characteristics between the two groups, which may affect the outcomes of interest. The matching method can mitigate the potential effect from the endogenous selection in treatment.

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<sup>13</sup>Only exporting firms can receive export credit supports from the agencies.

<sup>14</sup>Given that most firms in Korea are familiar with the public export credit services, potential bias issues related to a firm's choices of applying for public export credit services can be alleviated

### 3.3 Variables

This subsection explains how dependent and independent variables are defined. The outcomes of interest in our estimation are firms' export activities and domestic performance. To measure the export activities, we use the firm-level export (the value of total export) and export intensity (the ratio of export to sales). For the domestic performance, we use the firm-level employment (the number of total workers), capital (the value of tangible fixed assets), sales (the value of total sales), and labour productivity (value-added per worker) as response variables. Let  $t$  be the year when a firm receives the public export credit service. We measure the log change in the outcome of interest between a year before the support,  $t-1$ , and in the following years,  $t$ ,  $t+2$ , and  $t+4$ .

In the probit estimation, we use a comprehensive list of firm characteristics to control for endogenous selection of firms in treatment. One of the variables that may affect the selection is the firm's financial status. Firms with severe financial constraints are more likely not to receive trade finance services from private financial institutions, and tend to have the services from the ECAs. To control for the financial status, we include a current ratio (the ratio of current assets to current liabilities) and a tangible asset ratio (the ratio of tangible assets to total assets) in the pre-treatment year,  $t-1$ .

Other variables most likely to influence both selection and outcomes are the firm's previous input, output, and global activities. To control for the input, we include employment and capital stock in year  $t-1$ . To control for the output, we include total sales and labor productivity in year  $t-1$ . To control for the global activities, we add foreign affiliate dummy (whether a firm has at least one affiliate abroad), foreign ownership dummy (whether a firm is owned by a foreign company), import (the value of total import), import intensity (the ratio of import to sales), export, and export intensity in year  $t-1$ . Capital, sales, and value added are translated into deflated real terms using the 2010 two-digit deflator from the Bank of Korea.

All continuous control variables are in the log format. We additionally control the (log) change in the firm's financial status, input, output, and global activities between year  $t-2$  and  $t-1$ , since a previous trend in growth of a firm may affect the growth in the future. Finally, we add the two-digit industry and year dummy in the probit model for matching in order to control for industry-specific growth and macroeconomic shocks.

## 4 Results

In this section, we present probit estimates of receiving export credit services from ECAs. We then pair treated firms with control firms using estimated propensity scores and show whether the matching performs well or not. We move to our main estimation, the effect of ECAs' support on firm export and domestic performance. Finally, we examine the robustness of the main results by controlling our sample further.

### 4.1 First-stage Probit Estimates

We implement the first-stage probit estimation and calculate the propensity score for matching. Columns (1) and (2) of Table 2 report the estimates of the probit model. Even if we use the probit model to calculate the propensity score, we find some interesting patterns from the estimates. Firms of weaker financial status are more likely to receive the support from the ECAs, possibly because they cannot access similar services from private financial institutions. Further, firms with higher levels of capital, productivity, and export intensity are more likely to have public export credit supports. Lagged growth in employment and capital show that growing firms are more likely to receive the support from ECAs. The estimates from the probit model suggest that large or productive but financially constrained firms are more likely to receive export credit support from the ECAs.

With the propensity score estimated in the probit model, we can choose a control firm that is the nearest neighbour for each treated firm. We compare the summary statistics of observable characteristics in the treated and control firms in columns (3)–(5) of Table 2. The statistics show some differences in firm characteristics between two groups. However, columns (6) and (7) show that there are no significantly systematic differences between the treated and control firms. The estimates show that we set a valid control group to identify the effect of public export credit services on firms.

### 4.2 Effect of ECAs on Firms

With the valid control group, we now compare the change in the outcomes of treated and control firms. Table 3 reports the average treatment effect of public export credit services on firm export and domestic performance. The first and second rows of Table 3 show positive and significant effects of ECAs' services on firm export activities. The supported firms in year  $t$  show of a growth rate in exports about 64% higher than control firms. The magnitude of the impact on export values has increased over time. The second row shows that the public

export credit support has a significant positive effect on export intensity. Two years after the treatment, the export intensity of treated firms increased by about 8% higher relative to the control firms. We conclude that the firms supported from the ECAs show higher growth in both export values and intensity relative to the similar but unsupported firms. The results suggest that the firms grow stably in the global markets after receiving the support.

Next, we examine the effect of export credit support on firms' domestic performance, given that one of the ECAs' goals is to support domestic jobs and the economy. The third to sixth rows of Table 3 describe the impact of the public support on firm employment, capital, sales, and labor productivity. The treated firms show a higher increase in employment than the control firms after receiving the support from ECAs. The results on employment coincide with the previous findings of a German study that finds a beneficial impact of export guarantees on firm-level jobs (Felbermayr et al., 2012). The effect of ECAs' services on employment is stable over four years after treatment. The positive impact of export credit support is also shown in capital and sales, but not in value-added per worker. The estimates on domestic performance show that the faster growth of the treated firms' output is from the faster growth in the inputs instead of the productivity.

### 4.3 Robustness Check

In order to check the robustness of our results, we control our sample in three ways. First, considering the long-term effect found in the main estimation, we control all export credit supports before the treatment year,  $t$ . If a firm receives any services from the ECAs in year  $t-2$  and the positive impact lasts more than two years, the previous export credit support can underestimate or overestimate the effect of treatment in year  $t$ . Now, in Panel A of Table 4, treated firms receive export credit supports at year  $t$  but not in years  $t-n$  to  $t-1$ , and control firms do not receive any support from the ECAs in years  $t-n$  to  $t$ . Panel A shows that the treated firms have higher growth rates in their exports and all domestic performance measures, excluding the labor productivity, compared to other firms that have similar characteristics but do not receive the public export credit services. We do not find any significant differences in the results with an additional restriction on the previous supports (from year  $t-n$  to  $t-2$ ) and without it.

Second, we additionally control all export credit supports from the ECAs after the treatment year. This is because the higher growth in the firm's export and domestic performance over two or four years after the treatment can be influenced by subsequent sequential supports, not necessarily by the support in year  $t$ . We exclude firms receiving any export credit

supports after year  $t$  in our sample. Panel B shows that the main results still hold after additionally controlling any supports from year  $t+1$  to  $t+n$ .

Lastly, in Panel C, we restrict our sample to firms that still export from year  $t$  to  $t+n$ , since there is a possibility of bias if the supported firms have a higher survival rate in the export market relative to the control firms. Similar to the main results, the supported exporting firms show higher growth in export and domestic performance than the similar exporting firms that do not receive the public export credit support.

## 5 Heterogeneous Effect

Our results suggest that export credit services from the ECAs have a positive effect on the performance of treated firms. Beyond estimating the average effect, in this section we investigate the heterogeneous effects in terms of the support's types and the firm characteristics. To deepen our understanding of the effects, first we examine whether the effect on firm differs between export insurance and loan. Second, we investigate who benefits the most from the public export credit support. In particular, we consider the prior export experience and the financial status of firms. By investigating the heterogeneous treatment effect across types and firms, we can infer potential mechanisms of the beneficial effect from ECAs on firms.

### 5.1 Type of Export Credit Support

As mentioned earlier, this paper uses datasets from two ECAs that offer different types of export credit support. K-SURE provides export insurance, while EXIM supplies an export loan service. Even if their goals are similar, mechanisms for promoting export and domestic performance of firms can be different. The export insurance can decrease the trade risk undertaken by exporters, while the export loans can alleviate financial constraints faced by them. To investigate what drives the treatment effect, we split samples into two groups, *K-SURE* and *EXIM*. Firms in the treatment group of *K-SURE* receive the export insurance service, while those of *EXIM* have the export loan in year  $t$ .

Table 5 reports estimates for two samples split by the support's types. Both types of support have a positive impact on firm export activities, but the export insurance service has larger and more consistent effect relative to the export loan support. We then examine whether the export insurance and loan services have different effects on domestic performance. The estimates show that firms receiving the export loan from EXIM show higher growth rates in employment, capital, and sales relative to the control firms. However, firms receiving

the export insurance from K-SURE show higher growth rates only in sales compared to the control firms. Neither of the supports has a significant effect on the labor productivity growth of firms, similar to the results of the main estimation. Considering the types of export credit support, we find that the higher export growth of the treated firms is attributable to the export insurance, while the higher domestic performance growth of the treated firms is attributable to the export loan. The results suggest that the export insurance support enables export growth, the primary goal of ECAs, while the export loan support has broader impacts, such as job growth.

## 5.2 Prior Export Experience

Given that new exporters tend to face more barriers to international trade than incumbent exporters (Eaton et al., 2014; Kohn et al., 2016), we examine whether the effect of public export support differs by the firms' export experience. We divide the sample into two groups, *New* and *Incumbent*. Firms in the *New* group do not export before year  $t$ , but start export in year  $t$ . Other firms in the *Incumbent* group have export experience from year  $t-n$  to  $t$ .

Table 6 shows that the effect of public export credit support varies by the firms' prior export experience. The support from ECAs has a positive effect on export of both treated groups, but the effect on the supported new exporters is larger than that of the supported continuing exporters. Regarding the effect on domestic performance, we find that the public export credit support has no significant effect on the new exporters. However, the supported exporters with export experience show higher growth rates in employment, capital, and sales relative to the unsupported exporters with export experience. The public export credit services seem to substantially promote the exports of the new exporter, achieving the primary goal. Different from the case of new exporters, the services from the ECAs have beneficial impacts on domestic performance of the continuing exporters, which is the fundamental goal of the ECAs.

## 5.3 Financial Status

Given that the financial status is an important factor in determining firms' export activity (Chaney, 2016; Paravisini et al., 2015; Niepmann and Schmidt-Eisenlohr, 2017), we additionally examine whether the public export credit supports are more effective in firms with financial constraints by mitigating their constraints. We split our sample into two groups:

firms with and without financial constraints. We first use a firm’s liquidity ratio<sup>15</sup>—the share of current assets minus short-term debt to total assets. Secondly, we use the macro financial shock, the global financial crisis. Dividing the sample into two groups based on two different criteria, we investigate the heterogeneous effect of ECAs across the financial status of firms. Through this further estimation, we can gain insight into potential mechanisms, such as whether the public export credit services promote firm export and domestic performance by alleviating the financial constraints faced by firms.

Table 7 shows the estimates of the two samples divided by the liquidity ratio of the firms. We first measure the annual liquidity ratio of firms and split the sample into five groups. Firms in the first and second quintiles are assigned to the *Below* group, and other firms in the fourth and fifth quintiles are assigned to the *Above* group. We can say firms in the *Below* group are more likely to face financial constraints than the others in the *Above* group. The results in Table 7 show that the treated firms in both groups show higher growth in their export, but the effects on domestic performance vary by the financial status of firms. The supported firms facing more financial constraints show higher growth in domestic performance, except for productivity, relative to the financially constrained but unsupported firms. However, when firms have relatively less financial constraints, they do not show significantly different growth patterns in terms of employment, capital, and sales compared to the control firms with similar liquidity ratios. This indicates that the public export credit support has a beneficial effect on domestic performance by mitigating the firms’ financial constraints.

In the last estimation, we investigate the effect of the support during the global financial crisis, when many exporters experienced financial troubles due to the shrinking of credit supply from private financial institutions (Paravisini et al., 2015; Niepmann and Schmidt-Eisenlohr, 2017). We use 2008 and 2009 as the reference years for extensive financial difficulties, and 2012 and 2013 as the non-crisis years. We use two years as a single period by calculating the average of the variables for the two years. We divide the sample into two groups—firms exporting in 2008–2009, *GFC*, and in 2012–2013, *Non-GFC*. The treated firms in the *GFC* group receive the public export credit support when they face relatively severe financial constraints, while the treated firms in the *Non-GFC* group receive the same support when they have relatively less severe financial constraints.

Table 8 shows that the support from ECAs has a positive effect on firm exports in both periods. However, the effect on firms’ domestic performance is different between the periods.

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<sup>15</sup>In measuring the financial constraints for a firm, most studies used company balance sheets to measure a firm’s financial status (Görg and Spaliara, 2018; Paravisini et al., 2015).

The firms supported in the financial crisis show significantly higher growth in capital and sales relative to the unsupported firms in the same period. However, the firms supported in the post-financial crisis do not show any significantly higher increases in domestic performance compared with firms not supported in that period. The results are consistent with the findings of previous studies, which examined the effect of export guarantees in the financial crisis (Felbermayr et al., 2012). Given the results of Table 7 and 8, we can infer that the support from the ECAs relieves the financial constraints of firms and is particularly conducive to employment, capital accumulation, and production.

## 6 Conclusion

Many countries have ECAs to promote export of domestic firms, create jobs, and benefit their economy, but the effect of whole export credit supports from ECAs has not been adequately explored yet. Recent studies examine the effect of public export insurance on firms, but it is the effect of only part of services that ECAs provide. Using novel and rich firm-level data, this study investigates the effects of both export insurance and loan services from ECAs on firms. We additionally examine whether the effects vary by the support types and the firm characteristics—prior export experience and financial status. We employ the difference-in-difference method with a propensity score matching technique to address the selection bias.

Using Korean data, this study answers the key policy question on ECAs: whether the public export credit services promote export, employment, and the domestic economy. We show that firms supported by the ECAs show higher growth rates not only in exports but also in employment, capital, and sales relative to similar firms that are not supported. The analysis on domestic performance shows that the faster growth of treated firms' output comes from the faster growth of the inputs, not the productivity. With additional estimations, we provide evidence that the export loan support has a beneficial effect on domestic performance, whereas export insurance support shows a larger and consistent effect on firm export activities relative to the loan support. Furthermore, we examine the heterogeneous effects of the export credit support across firms by their prior export experience or financial status. Our results show that the public export credit services have a positive effect on the export activities of both new and continuing exporters. However, significant beneficial impacts on domestic performance are only shown in the continuing exporters group. In the final estimate, we find that the public export credit support is more effective for the firms' domestic



performance growth when they are faced with financial constraints. Supported firms that have low liquidity ratios or that were experiencing the global financial crisis show consistently higher growth rates in both exports and domestic performance than the control firms with financial constraints. However, supported firms that have high liquidity ratios or that are in the non-crisis period show higher growth rates only in exports, not in domestic performance relative to the control firms without financial constraints. Given the estimates, we can infer that the ECAs promote export and domestic performance of firms by mitigating their financial constraints. The last estimates imply that the public support from ECAs can ameliorate the negative macro shocks in the economy. We believe that understanding the effect of public export credit support is valuable in building more effective financial export support.

Using the novel Korean firm-level data and employing the difference-in-difference method with the propensity score matching, we show the beneficial effect of public export credit supports on firm export and domestic performance. Nonetheless, there are several limitations to the current approach. First, while we can control the firm characteristics in our model, the lack of data on export destination prevents us from controlling the heterogeneity related to the destination. Second, our analyses only consider whether a firm receives export credit support (extensive margin), without considering the size of the support (intensive margin). The effect would be heterogeneous depending on the support's size, but due to data limitations, the size of the support cannot be considered in this paper. Future studies should fruitfully explore these issues further by controlling the heterogeneity from destination and examining both the intensive and the extensive margins of ECAs' effects on firms with more detailed data.

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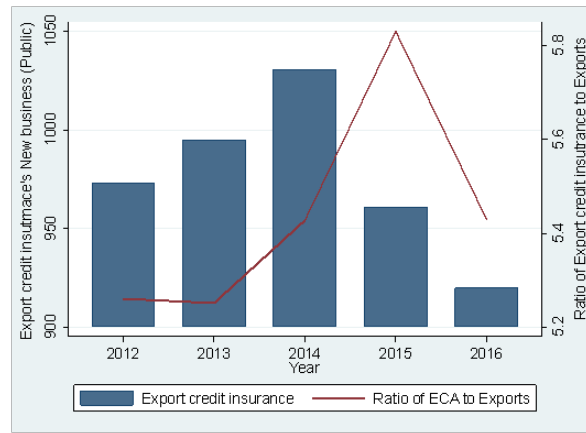
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Figure 1: Volume and Ratio of Global Export Insurance from ECAs



Source: Berne Union (2016); World Bank. Accessed: July 15, 2019. Unit: Billion USD.

Table 1: Summary Statistics of the Number of Manufacturing Firms

Year	Firms	Export Firms	ECA	K-SURE	EXIM	K-SURE & EXIM
2006	5,906	3,236	677	256	525	104
2007	5,773	3,434	761	282	587	108
2008	5,745	3,459	800	292	635	127
2009	5,432	3,531	909	294	744	129
2010	5,286	3,339	963	327	787	151
2011	5,703	3,413	937	346	739	148
2012	6,038	3,636	918	366	712	160
2013	5,959	3,675	887	328	691	132
2014	5,813	3,624	856	341	660	145
2015	5,688	4,604	980	400	736	156
Average	5,734	3,595	868	323	681	136

Notes: Export credit agencies (ECAs) consist of K-SURE and the Export-Import Bank of Korea (EXIM). The value in the “K-SURE” or “EXIM” column refers to the number of exporters in manufacturing sectors receiving export credit supports from either K-SURE or EXIM. The value in the “K-SURE & EXIM” column refers to the number of exporters in manufacturing sectors receiving export credit supports from both K-SURE and EXIM.

Table 2: Probit Estimation and Characteristics of Treated and Control Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ECA	SE	Treated	Control	Bias	T	$P >  t $
Current ratio	-0.043**	(0.019)	1.729	1.803	-2.4	-0.58	0.560
Tangible asset ratio	-0.562***	(0.161)	0.355	0.350	2.3	0.51	0.611
ln(Employment)	0.056	(0.042)	5.208	5.253	-5.6	-1.04	0.297
ln(Capital)	0.142***	(0.034)	9.848	9.888	-3.0	-0.60	0.546
ln(Labor productivity)	0.095**	(0.040)	4.312	4.300	1.9	0.39	0.698
ln(Exports)	0.017*	(0.009)	8.534	8.497	1.1	0.24	0.814
ln(Imports)	0.006	(0.007)	5.356	5.542	-4.2	-0.86	0.389
Exports/Sales	0.573***	(0.089)	0.317	0.321	-1.5	-0.29	0.773
Imports/Sales	-0.253	(0.175)	0.099	0.103	-2.3	-0.48	0.630
$\Delta$ Current ratio	0.037**	(0.017)	0.010	-0.013	1.4	0.35	0.725
$\Delta$ Tangible asset ratio	-0.864***	(0.313)	-0.003	-0.0003	-4.5	-0.90	0.366
$\Delta$ ln(Employment)	0.201**	(0.084)	0.040	0.054	-6.1	-1.22	0.222
$\Delta$ ln(Capital)	0.230***	(0.064)	0.130	0.157	-7.1	-1.15	0.251
$\Delta$ ln(Labor productivity)	0.008	(0.043)	0.066	0.060	1.3	0.26	0.794
$\Delta$ ln(Exports)	-0.006	(0.008)	0.584	0.365	6.4	1.40	0.163
$\Delta$ ln(Imports)	-0.00632	(0.007)	0.354	0.545	-5.2	-1.05	0.292
$\Delta$ (Export/Sales)	-0.246**	(0.101)	0.029	0.022	3.0	0.61	0.543
$\Delta$ (Import/Sales)	0.264	(0.176)	0.009	0.016	-5.2	-1.03	0.302
Foreign affiliate dummy	0.119***	(0.040)	0.639	0.661	-4.5	-0.95	0.340
Foreign ownership dummy	-0.883***	(0.090)	0.032	0.032	0.0	0.00	1.000
Constant	-4.006***	(0.215)					
Year FE	O						
Industry (2digit) FE	O						
Observations	17,170						

Notes: Dependent variables in column (1) are set to be 1 if a firm receives any export credit supports from K-SURE or EXIM in year  $t$ ; otherwise, it is 0. Employment is the number of full-time workers. Capital is the tangible fixed asset. Current ratio is the ratio of current assets to current liabilities. Tangible asset ratio is the ratio of tangible assets to total assets. Labor productivity is the value-added per worker. All control variables are values for year  $t-1$  (an year before treatment), and the dependent variables are the log difference between the values in year  $t-1$  and  $t-2$ . Firms that received official export supports from Korean ECAs in year  $t$  but not in year  $t-1$  are classified as the treatment group. Firms that did not receive any export supports from the ECAs in  $t$  and  $t-1$  years are classified as the control group. The nearest neighbour matching is employed.

Table 3: Effect of Export Credit Supports on Firm Export and Performance

	ATET, t	t-stat	ATET, t+2	t-stat	ATET, t+4	t-stat
$\Delta\ln(\text{Exports})$	0.499	3.41	0.856	3.68	1.058	3.77
$\Delta\ln(\text{Export share})$	0.058	4.04	0.079	4.49	0.064	3.00
$\Delta\ln(\text{Employment})$	0.034	2.88	0.065	3.19	0.114	3.73
$\Delta\ln(\text{Capital})$	0.057	3.73	0.100	2.84	0.149	3.32
$\Delta\ln(\text{Sales})$	0.061	4.38	0.121	4.40	0.170	4.18
$\Delta\ln(\text{Labor productivity})$	-0.005	-0.22	0.012	0.35	0.084	1.91
Observation	1,744		1,224		896	

Notes: All coefficients indicate the average treatment effects on the treated group. Dependent variables are the log differences in firm exports or performance between year  $t-1$  and  $t$ ,  $t+2$ , or  $t+4$ . Export share is the ratio of exports to sales. Labor productivity is the value-added per worker.

Table 4: Robustness Checks

	ATET, t	t-stat	ATET, t+2	t-stat	ATET, t+4	t-stat
<i>A. No export support from t-1 to t-1 years</i>						
$\Delta\ln(\text{Exports})$	0.462	2.94	1.071	4.06	0.988	3.23
$\Delta\ln(\text{Export share})$	0.062	4.30	0.092	4.81	0.060	2.58
$\Delta\ln(\text{Employment})$	0.026	2.01	0.072	3.38	0.090	3.20
$\Delta\ln(\text{Capital})$	0.048	2.52	0.124	2.66	0.161	3.12
$\Delta\ln(\text{Sales})$	0.050	3.22	0.151	5.04	0.177	4.24
$\Delta\ln(\text{Labor productivity})$	-0.035	-1.31	-0.002	-0.05	0.111	2.30
Observations	1,370		986		736	
<i>B. No additional export support from t+1 to t+4 years</i>						
$\Delta\ln(\text{Exports})$	0.694	4.85	1.123	4.48	0.778	2.57
$\Delta\ln(\text{Export share})$	0.065	4.67	0.077	4.18	0.077	3.34
$\Delta\ln(\text{Employment})$	0.028	2.30	0.048	2.25	0.119	3.85
$\Delta\ln(\text{Capital})$	0.1.00	3.63	0.134	2.92	0.126	2.14
$\Delta\ln(\text{Sales})$	0.076	4.72	0.120	4.06	0.164	3.94
$\Delta\ln(\text{Labor productivity})$	0.022	0.86	0.030	0.78	0.119	2.70
Observations	1,592		1,072		768	
<i>C. Exporter from t to t+4 years</i>						
$\Delta\ln(\text{Exports})$	0.637	3.09	0.665	3.11	0.599	2.80
$\Delta\ln(\text{Export share})$	0.062	2.88	0.069	2.98	0.059	2.49
$\Delta\ln(\text{Employment})$	0.036	1.92	0.073	2.66	0.064	1.89
$\Delta\ln(\text{Capital})$	0.028	1.03	0.092	2.17	0.126	2.34
$\Delta\ln(\text{Sales})$	0.075	3.00	0.099	2.88	0.111	2.79
$\Delta\ln(\text{Labor productivity})$	0.024	0.64	-0.004	-0.10	0.070	1.50
Observations	648		648		648	

Notes: All coefficients indicate the average treatment effects on the treated group. Dependent variables are the log differences between firm exports or performances in  $t-1$  and  $t$ ,  $t+2$ , or  $t+4$  years. Export share is the ratio of exports to sales. Labor productivity is the value-added per worker. In Panel A (or Panel B), firms that received official export supports from Korean ECAs in year  $t$ , but not before (or after) year  $t$  are classified as the treatment group. In Panel A (or Panel B), firms that did not receive any export supports from ECAs in and before (or after) year  $t$  are classified as the control group. In Panel C, the sample consists of firms that exported from  $t$  to  $t+4$  years.

Table 5: Considering Type of Export Credit Supports

	ATET, t	t-stat	ATET, t+2	t-stat	ATET, t+4	t-stat
$\Delta\ln(\text{Exports})$						
<i>K-SURE</i>	0.745	4.40	0.779	2.62	1.180	2.86
<i>EXIM</i>	0.314	1.92	0.353	1.35	0.666	2.13
$\Delta\ln(\text{Export share})$						
<i>K-SURE</i>	0.069	4.30	0.065	2.66	0.094	3.18
<i>EXIM</i>	0.040	2.41	0.047	2.37	0.037	1.51
$\Delta\ln(\text{Employment})$						
<i>K-SURE</i>	0.001	0.05	0.007	0.28	0.039	0.94
<i>EXIM</i>	0.032	2.26	0.073	3.17	0.117	3.64
$\Delta\ln(\text{Capital})$						
<i>K-SURE</i>	0.022	0.92	0.004	0.09	0.005	0.07
<i>EXIM</i>	0.081	4.32	0.149	3.36	0.204	4.11
$\Delta\ln(\text{Sales})$						
<i>K-SURE</i>	0.037	2.31	0.075	2.24	0.100	1.83
<i>EXIM</i>	0.046	2.80	0.144	4.47	0.152	3.53
$\Delta\ln(\text{Labor productivity})$						
<i>K-SURE</i>	0.012	0.39	0.034	0.74	0.150	2.60
<i>EXIM</i>	-0.015	-0.53	0.046	1.14	0.035	0.72
Observation	1,112 / 1,280		674 / 1,000		440 / 758	

Notes: All coefficients indicate the average treatment effect on the treated group. Dependent variables are the log differences between firm's exports or performances in  $t-1$  and  $t$ ,  $t+2$ , or  $t+4$  years. Treatment group in *K-SURE* (*EXIM*) estimation includes firms receiving supports from *K-SURE* (*EXIM*).



Table 6: Considering Prior Export Experience of Firms

	ATET, t	t-stat	ATET, t+2	t-stat	ATET, t+4	t-stat
$\Delta \ln(\text{Exports})$						
<i>New</i>	1.109	2.60	1.228	2.48	2.599	2.88
<i>Incumbent</i>	0.499	3.41	0.856	3.68	1.058	3.77
$\Delta \ln(\text{Export share})$						
<i>New</i>	0.084	1.67	0.114	2.12	0.165	2.58
<i>Incumbent</i>	0.058	4.04	0.079	4.49	0.064	3.00
$\Delta \ln(\text{Employment})$						
<i>New</i>	-0.059	-1.47	-0.030	-0.49	-0.027	-0.26
<i>Incumbent</i>	0.034	2.88	0.065	3.19	0.114	3.73
$\Delta \ln(\text{Capital})$						
<i>New</i>	-0.081	-1.70	0.021	0.15	0.043	0.26
<i>Incumbent</i>	0.057	3.73	0.100	2.84	0.149	3.32
$\Delta \ln(\text{Sales})$						
<i>New</i>	-0.061	-1.22	0.042	0.45	-0.011	-0.09
<i>Incumbent</i>	0.061	4.38	0.121	4.40	0.170	4.18
$\Delta \ln(\text{Labor productivity})$						
<i>New</i>	-0.148	-1.65	0.043	0.43	0.084	0.57
<i>Incumbent</i>	-0.005	-0.22	0.012	0.35	0.084	1.91
Observation	176 / 1,744		104 / 1,120		32 / 834	

Notes: All coefficients indicate the average treatment effect on the treated group. Dependent variables are the log differences between firm's exports or performances in  $t-1$  and  $t$ ,  $t+2$ , or  $t+4$  years. *New* group includes firms that did not export before year  $t$  but started to export in year  $t$ . *Incumbent* group includes firms that exported in  $t-n$  to  $t$  years.

Table 7: Considering Financial Status of Firms

	ATET, t	t-stat	ATET, t+2	t-stat	ATET, t+4	t-stat
$\Delta\ln(\text{Exports})$						
<i>Below</i>	0.825	4.07	0.633	1.81	1.120	2.59
<i>Above</i>	0.538	2.11	0.385	1.61	1.318	2.92
$\Delta\ln(\text{Export share})$						
<i>Below</i>	0.087	4.50	0.057	2.23	0.080	2.51
<i>Above</i>	0.054	2.41	0.060	1.89	0.097	2.78
$\Delta\ln(\text{Employment})$						
<i>Below</i>	0.039	2.16	0.105	3.36	0.132	2.93
<i>Above</i>	0.007	0.35	0.029	0.85	0.074	1.74
$\Delta\ln(\text{Capital})$						
<i>Below</i>	0.084	2.53	0.231	3.47	0.077	1.10
<i>Above</i>	0.007	0.25	0.053	0.83	0.107	1.30
$\Delta\ln(\text{Sales})$						
<i>Below</i>	0.054	2.23	0.152	3.55	0.18	2.96
<i>Above</i>	0.051	2.09	0.119	2.30	0.118	1.91
$\Delta\ln(\text{Labor productivity})$						
<i>Below</i>	0.010	0.26	-0.061	-1.38	0.097	1.41
<i>Above</i>	0.025	0.69	0.075	1.32	0.044	0.62
Observation	868 / 528		618 / 372		444 / 284	

Notes: *Below* group includes firms whose liquidity ratio is below that of the third quintile group (firms in the first and second groups). *Above* group includes firms whose liquidity ratio is above that of the third quintile group (firms in the fourth and fifth groups). Dependent variables are the log differences between firm's exports or performances in  $t-1$  and  $t$ ,  $t+2$ , or  $t+4$  years. All coefficients indicate the average treatment effect on the treated group.

Table 8: Considering Global Financial Crisis

	ATET, $t - t+1$	t-stat	ATET, $t+2 - t+3$	t-stat
$\Delta \ln(\text{Exports})$				
<i>GFC</i>	0.359	2.11	0.527	2.22
<i>Non-GFC</i>	0.572	2.85	0.745	3.38
$\Delta \ln(\text{Export share})$				
<i>GFC</i>	0.042	3.07	0.024	1.49
<i>Non-GFC</i>	0.038	2.38	0.051	3.09
$\Delta \ln(\text{Employment})$				
<i>GFC</i>	0.019	1.12	0.041	1.47
<i>Non-GFC</i>	-0.010	-0.66	-0.020	-0.91
$\Delta \ln(\text{Capital})$				
<i>GFC</i>	0.074	2.36	0.093	1.56
<i>Non-GFC</i>	0.038	1.48	0.030	0.69
$\Delta \ln(\text{Sales})$				
<i>GFC</i>	0.077	3.53	0.065	2.18
<i>Non-GFC</i>	-0.005	-0.23	0.014	0.44
$\Delta \ln(\text{Labor productivity})$				
<i>GFC</i>	0.072	2.17	0.007	0.19
<i>Non-GFC</i>	0.021	0.70	0.080	2.19
Observation	1,568 / 1,704		1,492 / 1,614	

Notes: All coefficients indicate the average treatment effect on the treated group. Dependent variables are the log differences average firm exports or performances in  $(t-2 - t-1)$  and  $(t - t+1)$  or  $(t+2 - t+3)$ . The treatment group in *GFC* estimation includes firms that receive export credit supports from the ECAs in the period 2008-2009 and those in *Non-GFC* estimation includes firms that receive the supports in the period 2012-2013.