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INUI Tomohiko
Nihon University

MIYAKAWA Daisuke
Development Bank of Japan

SHOJI Keishi
House of Representatives

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Research Institute of Economy, Trade & Industry, IAA

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INUI Tomohiko [a]
Nihon University
MIYAKAWA Daisuke [b]
Development Bank of Japan
SHOJI Keishi [c]
House of Representatives

Abstract

This paper empirically studies the impact of banks' efficiency on their client firms' export behavior. Our empirical analysis shows that the marginal impact of the total factor productivity (TFP) of cash-flow constrained firms to the extensive margin of exports increases as the efficiency of top lender banks improves. This channel is important for initiating exports but is neither for sustaining the export status nor the intensive margin. It implies that the main role of banks is to help prominent firms cover the fixed cost associated with the start-up of exports. These results also imply that it is necessary to relate various firm dynamics to the detailed characteristics of the banks having relationships with the firms.

Keywords: Bank efficiency; Firm export; Extensive margin
JEL classification: F10, G21

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[a] Professor, College of Economics, Nihon University, 1-3-2 Misakicho, Chiyoda-ku, Tokyo 101-8360, JAPAN. Tel & Fax: +81-3-3219-3468. E-mail: inui.tomohiko@nihon-u.ac.jp
[b] Associate Senior Economist, Research Institute of Capital Formation, Development Bank of Japan, 1-9-3 Otemachi Chiyoda-ku, Tokyo 100-0004, JAPAN. Tel: +81-3-3244-1917, Fax: +81-3-3270-7084. E-mail: damiyak@dbj.jp.
[c] Researcher, Research Office on Budget, Research Bureau, House of Representatives, 1-7-1 Nagatacho, Chiyoda-ku, Tokyo 100-0014, JAPAN. Tel: +81-3-3581-5111, Fax: +81-3-3581-7750. E-mail: s10425@shugiinjk.go.jp.

1. Introduction

After long economic stagnation in 1990s, Japanese exports had started to play a major role in her recovery initiated in 2002. However, the world financial turmoil in 2008 and the subsequent rapid appreciation of the yen are making it increasingly difficult for the Japanese firms to sustain its international competitiveness and expand their exports. According to the trade statistics by Ministry of Finance Japan, for example, the total amount of Japanese export in the first six months of 2009 declined by 43% compared to the corresponding period in the previous year. In fact, such a large decline in exports did not occur only in Japan, but also in many countries. This phenomenon and the similar experiences after the past financial crisis have been stipulating a number of empirical studies on the link between financial constraints and firm export behavior (e.g., Amiti and Weinstein 2011; Bellone et al. 2011; Feenstra et al. 2011).[1] The main purpose of this paper is to empirically study this linkage. In particular, the detailed information about firms' export behavior and the lender banks' information allow us to investigate how the efficiency of banks affects their client firms' export dynamics.

Many empirical studies inspired by Melitz (2003) have been already establishing the key mechanism that firm's Total-Factor-Productivity (TFP) positively affects the possibility of their export behavior. A few recent empirical studies, however, have reported some controversial results. For example, Bernard et al. (2003), Mayer and Ottaviano (2008), and Todo (2011) point out that firm's TFP tends to have a statistically significant

[1] In addition to the shocks to supply side of export (i.e., exporter firms and the related parties supporting the exports such as banks), there are potentially many demand side factors related to the recent financial turmoil. While the main theme of this paper is to study the impact of bank efficiency as a factor affecting the supply side of exports, we would control such demand factors as serious as possible since we presume that such demand factors certainly play a central role especially after recent financial crisis.

positive impact on its export behavior, but the size of impact is economically negligible. In particular, Todo (2011) finds that the dominant determinants of the export and FDI decision of Japanese firms are their status on internationalization in the previous year and unobserved firm characteristics.

Corresponding to these findings, we consider the financial constrains faced by each firm against their participation to the international markets as an unobserved firm characteristics.[2] In this context, a number of extant literatures have been already employing firms' own characteristics such as debt to asset ratio and/or bank dependency ratio as the proxies for financial constraints. Employing these variables as proxies could be, however, misleading because the firm being able to easily finance may have higher debt to asset ratio or bank dependency ratio simply as the consequence of their high financial availability. In fact, as pointed out in the extant studies (e.g., Abel and Eberly 2011; Gomes 2001), these variables tend to have high correlations with firms' future profitability. Hence, high debt ratio or high bank dependency ratio of the firm might not necessarily represent the financial constrain per se.

In order to implement a cleaner empirical examination featuring financial constraints, we use the matched data between the firm and its top lender. Such a match-level data allows us to disentangle the factors in supply and demand of finance in a cleaner way.[3] We presume that the more efficient bank has a better screening, monitoring, and/or advising abilities. Thanks to these, firms with more efficient bank enjoy less

[2] We also control the export status in the previous years by either employing the dummy variable for the lagged export status or focusing on the samples which have not exported until the previous year.
[3] As one example explicitly considering both the demand and supply of finance in a neat way, see Peek and Rosengren (2000).

financial constraints, which eventually lead to the better access to the overseas business opportunities. This mechanism becomes more important when the client firms are facing larger cash-flow constraint and need to rely on their lender banks. In this paper, we use the firm level data over the period between 1997 and 2008 fiscal year stored in Basic Survey of Japanese Business Structure and Activities (BSBSA), which we detail later. We combine this firm-level data with the characteristics of the top lender banks for each firm. The targets of this paper is to investigate (i) whether the firms with more efficient banks have higher probability to export, (ii) how the channel is interacted with firms' own characteristics, and if so, (iii) how the channel affects the extensive and/or intensive margins of exports. Following the previous literatures on firm export dynamics, we control the firm characteristics such as its TFP level, and examine additional effects associated with firm financial constrain and its top lender bank's efficiency on the export behavior.

Our dataset contains the information about firms' export behavior in detail. The description consists of whether the firm has already exported in the previous period or not as well as the export status in the current period. This information is stored for each year and each destination region of exports. Such a detailed information about export dynamics allows us to investigate when the efficiency of lender banks matter (e.g., for initiating and/or sustaining the export status). This issue has not been fully studied in the literature and provides an additional understanding about the role of banks in the context of firms' overseas activities.

The results obtained from the Probit and Heckman selection models as well as OLS show that it becomes more likely for firms to export as their lender banks are more

efficient. On the other hand, the export to sales ratio (i.e., intensive margin) is not affected by the bank efficiency. We also find that the former channel becomes more sounding when the firms are facing larger cash-flow constraints, which is kept to be significant even if we control firms' past experiences of exports as in Todo (2009). Interestingly, the lender banks' efficiency contributes to the initiation of their client firms' exports while it does not help firms to sustain the export status. It implies that the role of efficient banks is mainly for supporting the firms to cover the fixed cost associated with exports but not for the variable cost.

These findings also provide some policy implication. First, it clarifies the importance of governmental supervision for banking industry. It could crucially affect firm's real activity through the channel examined in this paper. Second, governmental credit provision during, for example, financial turmoil could be justified so as to encourage productive firms to smoothly initiate overseas activities.

The remainder of the paper is organized as follows. The next section overviews the literature on financial constraints and firm export behavior. Section 3 describes the data and the construction of variables, and Section 4 investigates the link between Japanese firm export behavior and the efficiency of banks that provide it with finance. Section 5 concludes and discusses the future research questions.

2. Literature Review

Many extant empirical studies have been testing the empirical implication obtained in Melitz (2003), which theoretically explains the mechanism on how the

heterogeneity in firms' productivity proxied for by TFP affects their export decision. Recent theoretical studies have also discussed the environment where firm's TFP cannot be a sufficient statistics for its export decision. As one example, Chaney (2005) augments Melitz-type model with liquidity constraints, which interacts with the heterogeneity of firm productivity. It aims at theorizing the mechanism that firms might lose the potential profit associated with export because of financial constraints. The direct empirical implication of the model is that firms with higher TFP in the domestic market as well as richer liquidity are more likely to export. As a corresponding empirical study, the survey analysis in Campello et al. (2010) provides an empirical finding supporting such a story by documenting that many CFOs in the U.S., EU, and Asian countries gave up promising projects and downsized the ongoing projects due to the lack of external finance during financial crisis.[4] Bellone et al. (2010) also uses French manufacturing companies' data to establish that firms entering export markets tend to have a financial advantage prior to such an entry.

The theoretical illustration and the empirical validation of the interaction between firms' TFP and financial constraint in the context of exports sound plausible. Yet, the choice of the appropriate proxy for financial constraint still remains as an controversial issue. Many candidate variables including firm's size, profitability, liquidity ratio, cash flow, solvency, intensity of trade credit usage, debt repaying ability, and some indexes summarizing those have been proposed in the literature (Bellone et al. 2010).[5] For

[4] There also exist the studies on the impact of financial friction onto firm's foreign direct investment (FDI), which we do not explicitly analyze in this paper. The impact of financial friction on the aggregate productivity of each country (e.g., Gorodnichenko and Schnitzer 2010) is another important issue discussed in the literature.

[5] Bellone et al. (2010) uses, for example, total assets, ROA, liquidity ratio, equity ratio, trade credit over total

example, Muûls et al. (2008) uses the credit ratings provided by credit guarantee companies in Belgium while Gorodnichenko and Schnitzer (2010) employs the information in Business Environment and Enterprise Performance Survey (BEEPS), which stores the difficulty of access to external finance and the cost of external finance for Eastern Europe and Commonwealth of Independent States (CIS). Manova et al. (2011) focuses on the financial vulnerability of various industries in China, which is represented by the status of domestic firms, the larger dependence on external finance, higher inventory-to-sales ratio, and/or lower asset tangibility, to show that the credit constraints restrict the international trade flows of the industry. Minetti et al. (2011) employs the survey data consisting of 4,680 manufacturing companies in Italy about credit rationing. They carefully control the productivity and other relevant firm attributes to account for the endogeneity of credit rationing, and conclude that firms encountering credit rationing decrease the profit margin of export (i.e., the deference between the profit with and without exports) by 39% and foreign sales.[6] They also show that the mechanism becomes more sounding in the industries which heavily rely on external finance (e.g., high-technology sectors). Manole et al. (2010) features the 365 export firms' data in Czech Republic. They establish that the firms with lower liquidity constraint represented by larger real cash flow tend to entry export markets. Based on this result, they recommend the development of financial market as an important policy target since it allows the domestic firms to benefit from the business opportunity in foreign countries. All of these studies agree on the negative impact of financial constraint on firms' export behavior.

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assets, and the ratio of financial debt to cash flow to represent these characteristics.

[6] They use the number of bank branches each firm is facing as an instrument variable for the credit rationing.

A number of recent studies, however, provided some controversial results. For example, Stiebale (2011) uses French manufacturing data obtained from AMADEUS database and show that the effects of financial indicator on the entry decision to export market and overseas sales disappear once they properly control firm heterogeneity including size and productivity. They emphasize that it is more important to financially support the innovation and the improvement in productivity for fostering firms' overseas activities than simply providing liquidity. Buch et al. (2009) employs the data of German multinational firms to conclude that the constraint in domestic financial markets does not affect the sales of foreign branches although the constraint faced by foreign branches matters. They conjecture that the domestic financial friction does not matter for the intensive margin of exports once firms establish it. Muûls et al. (2008) also establish that the credit constraint does not matter for the sales of foreign branches although the decision associated with the entry to export market itself is affected by the productivity and financial constraint. They conclude that the importance of domestic financial friction becomes lower once the firms open foreign branches, which is more likely to be affected by the cash-flow of those branches themselves. Finally, Greenway et al. (2007) focuses on the U.K. manufacturing data and represent firms' financial healthiness by liquidity ratio and leverage ratio to show the correlation between the likelihood of exporting and the financial healthiness. They point out the possibility that the financial healthiness is obtained as a result of entry to export markets, and alert the potential endogeneity of the correlation between firms' financial healthiness and the probability of exports.

We should note that all of these studies exclusively focus on the firms'

characteristics and ignore the status of financial institutions, which are supposed to fulfill the large portion of firms' financial needs. Only a very few recent studies have paid an attention to the supply side of finance. First, Amiti and Weinstein (2011) uses the main bank's book-to-market ratio as a proxy for the bank's financial healthiness and confirm such a characteristic affect client firms' export behavior. Second, Paravisini et al. (2011) uses Peruvian data, which includes the funding shock to Peruvian banks, to show that a 10% decline in credit provision reduces the export quantity by 2.3%, and the number of firms continuing to supply a same product-destination by 3.6%. They conclude the credit shortages explain 15% of the Peruvian exports decline during the 2008 financial crisis.

Our study is following such a strand of new literature with extending the study by (i) taking into account both the firm's and bank's characteristics as well as the interaction between them, (ii) employing a new efficiency measure for banks, and (iii) using a unique dataset containing the dynamics of firms' export such as the initiation and the termination of exports to multiple regions. We are particularly interested in how the banks with higher efficiency, which is presumably associated with higher ability to screen, monitor, and provide advices to client firms, could mitigate the financial friction faced by the client firms. Furthermore, it is also our main motivation to explicitly pin down the situations where the bank efficiency strongly matter for firms' export choice (i.e., the degree of cash-flow constraints faced by firms, the extensive and intensive margins of exports, and/or the initiation and the termination of exports). In this sense, our study aims at answering to the question on the way for credit constraints to be resolved (e.g., Feenstra et al. 2011).

3. Data and Variables

In order to obtain the information about firm's export dynamics, we use Basic Survey of Business Structure and Activities (BSBSA: Kigyo Katsudou Kihon Chosa) conducted by Ministry of Economy, Trade, and Industry in Japan. One of the main purposes of this survey is to quantitatively understand the actual globalization of Japanese enterprises. Corresponding to this aim, the survey covers the enterprises with 50 or more employees, and whose paid-up capital or investment fund is over 30 million yen.[7] Note although the coverage of the survey itself is quite large, the samples we can use for our empirical analysis is limited due to the availability of variables, which we will detail later.

To construct our dataset, first, we augment the firm-level panel data taken from the BSBSA with the firm characteristics stored in Development Bank of Japan Corporate Financial Databank. Then, the dataset is combined with the bank efficiency measured by the modified FISIM (Financially Intermediated Service Indirectly Measured) output used in SNA framework and banks' cost information, both of which are computed from the bank-level panel data stored in Nikkei NEEDS Financial Quest. Note that we limit our sample to the listed companies, only for which we have the loan relation data, so that we can match each firm to their lender banks.

FISIM is a concept for measuring bank output proposed in the discussion for extending SNA framework. It interprets bank's net interest profit, which stands for the loan interest receipts minus the deposit interest payments, as its output. As widely pointed out in the literature (e.g., Basu et al. 2008), however, such a notion is somewhat

[7] The coverage of industries are mining, manufacturing, and wholesale and retail trade, and eating and drinking places (excluding "Other eating and drinking places").

problematic. In fact, the output associated with bank's lending service should have been computed as the loan interest receipts minus the required market return for the borrower's funding in the hypothetical situation where information asymmetry does not exist. To illustrate, imagine the case where a firm is planning to finance its capital investment. If there is no information asymmetry about the firm's quality between the firms and outside financiers, the firm can freely borrow from the market at the rate reflecting its own risk. Due to the existence of information problem, however, the firm needs to rely on banks, which could potentially mitigate the problem and hence deserve rents. This is the reason why we need to measure the output associated with lending service by subtracting the required market return, which is computed in the hypothetical environment with no information asymmetry, from the actual loan interest receipts.[8]

Unfortunately, we could not generally observe the hypothetical required market return corresponding to the case without information problem. In this paper, we rely on the information on the allowance for loan losses, which we can observe in bank's balance sheet. In order to proxy for the credit risk taken by banks in ex-ante perspective, we use the average of the changes in the allowance for loan losses over the next three years from a given period where we attempt to measure bank output.[9] We use this information to quantify the average of the realized losses in banks' financial statement. Note that the

[8] Obviously, the output associated with deposit service could potentially suffer from the same problem. Ideally, we should construct the deposit output by subtracting the deposit interest payment from the depositor's required return for the bank in the case without the deposit insurance. In other words, the riskiness of each bank should be considered in the computation of the output. This idea is also capture in Figure-1. We believe, nonetheless, the possibility of bank failure is very low. Thus, we treat the risk-free rate and the required returns for banks in our sample are almost same.

[9] The number of periods over which we compute the risk should correspond to the average maturities of loans. Unfortunately, we do not have such detailed information about each bank's loan portfolio. As a robustness check, we employ five years to measure the risk. The empirical results are not altered due to this modification otherwise mentioned.

allowance for loan losses is the estimated losses out of the loan outstanding at each point. Thus, the average change in the allowance for loan losses could summarize credit risk associated with the loan asset from the ex-post perspective.[10] If the hypothetical financial market works well and the competition in the market is high enough, the credit risk observed ex-post could work as a good proxy for the credit risk estimated ex-ante (i.e., at the timing of loan provision). If this is the case, the hypothetical required market return for the loan asset could be set to the rate covering exactly such an ex-post observed credit risk. This is one justification for using the data on the allowance for loan losses to adjust the credit risk.[11]

NEEDS Financial Quest stores bank's financial characteristics. This data is an unbalanced bank-level panel data due to, for example, the merger and acquisition of banks. We use the identification of each bank based on the identity of each bank as of 2008 fiscal year. If a bank is merged with another bank before 2008, the recognized continuing bank at the timing of merger in the database is automatically treated as a survival one while all the other merged banks disappear thereafter from the dataset.[12]

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[10] It is important to note that the assets covered by the allowance for loan losses have not been processed as actual losses. In this sense, the change in the allowance for loan losses reflect the ex-post evaluation of the risk born by banks at each future date.

[11] Of course, the risk which should be covered here is the non-systemic risk. We will control the systematic risk by measuring the bank efficiency as the relative dispersion of each bank efficiency from the average level of all banks' efficiencies. As another remark, we have not adjusted the term-risk taken by banks, which corresponds to the duration gap between asset and liability held by banks. Since we do not have detailed information about the durations of banks' asset and liability in our dataset, we could not exactly adjust this risk component. Potential alleviation for this problem is to use the information about the asset and liability volumes in several categories (e.g., (i) loan outstanding to mortgage, capital investment, and (ii) liability outstanding from short-term and long-term deposits). We will leave this issue to the future research question.

[12] This means, for example, the financial data of Mizuho Bank is connected to that of Dai-ichi Kangyo Bank, Mizuho-Corporate Bank is connected to the information of Fuji Bank, Mitsubishi-Tokyo-UFJ is connected to Mitsubishi-Tokyo, which is originally connected to Mitsubushi Bank, Risona Bank is connected to Daiwa Bank, and so on. Among those data connection, sometimes the continuation looks somewhat controversial (e.g., Mitsui-Sumitomo Bank follows the financial characteristics of Wakashio Bank, which is relatively small among the member of the merger).

Before implementing the risk-adjustment to the original FISIM output, we process the following two steps. First, the gross output of bank in match f at the period t is measured by simply following basic FISIM concept (i.e., loan interest receipt minus deposit interest payment).

$$\text{Gross Output}_{f,j,t} = \text{Interest Receipt}_{f,j,t} - \text{Interest Payment}_{f,j,t} \quad (1)$$

where

$\text{Interest Receipt}_{f,j,t}$: Bank in match f in industry j's Interest Receipt during the period t

$\text{Interest Payment}_{f,j,t}$: Bank in match f in industry j's Interest Payment during the period t

This output measure in (1), however, are likely to be negative in many bank-year cases due to the mismatch of loan asset and deposit, which is a typical feature of Japanese banks. Corresponding to this problem, we adjust the deposit interest payment by multiplying the ratio of loan outstanding to deposit outstanding, and construct the so-called Balance-Sheet (B/S) Adjusted Output as defined in (2).

$$\text{B/S Adjusted Output}_{f,j,t} = \text{Interest Receipt}_{f,j,t} - \text{Interest Payment}_{f,j,t} \times \frac{\text{Loan Outstanding}_{f,j,t-1}}{\text{Deposit Outstanding}_{f,j,t-1}} \quad (2)$$

where

$\text{Loan Outstanding}_{f,t-1}$: Bank in match f in industry j's Loan Outstanding for firm in match f

$\text{Deposit Outstanding}_{f,t-1}$: Bank in match f in industry j's Deposit Outstanding

Through this modification, we virtually compute a net interest profit for the bank, which

finances all of the existing loan assets by deposit. Note that as a cost of this operation, we are inevitably forced to exclude the quality of asset-liability management in each bank from our analysis, which could be potentially an interesting research object.[13] Finally, we subtract the average of the changes in the allowance of loan losses over the following three years to each point as in (3).

$$\text{Risk Adjusted Output}_{f,j,t} = \text{B/S Adjusted Output}_{f,j,t} - \sum_{\tau=1}^{3} \frac{\left(\text{Allowance of Loan Losses}_{f,j,t+\tau} - \text{Allowance of Loan Losses}_{f,j,t+\tau-1}\right)}{3} \quad (3)$$

where

$\text{Allowance of Loan Losses}_{f,j,t}$: Bank in match f in industry j's Allowance of Loan Losses

Then, a raw measure of bank efficiency is computed through dividing this final output measure by the operating cost as in (4).

$$\text{RAW\_BANKEFFIC}_{f,j,t} = \frac{\text{Risk Adjusted Output}_{f,j,t}}{\text{Operationg Cost}_{f,j,t}} \quad (4)$$

where $\text{Operating Cost}_{f,j,t}$: Bank f in industry j's Operation Cost over the period t

Considering the fact that our measure of output is susceptible to the variation in the mark-up in banking markets, we standardize this by subtracting the concurrent sample mean and dividing it by the concurrent standard deviation. This operation also

[13] Note that we also exclude bank's business fee revenue associated with, for example, business consulting, remittance, or loan guarantee etc.

intends to exclude the systematic component, which mainly comes from some aggregate shocks, from our bank efficiency measure. The measure in (5) gives us the bank efficiency measure used in our empirical analysis.

$$\begin{cases} \mathrm{BANKEFFIC}_{f,j,t} = \dfrac{\mathrm{RAW\_BANKEFFIC}_{f,j,t} - \mathrm{MEAN}(\mathrm{RAW\_BANKEFFIC}_t)}{\mathrm{STD}\ (\mathrm{RAW\_BANKEFFIC}_t)} \\ \text{where} \\ \mathrm{MEAN}(\mathrm{RAW\_BANKEFFIC}_t):\ \text{Average of } \mathrm{RAW\_BANKEFFIC}_{f,j,t} \text{ for all banks at } t \\ \mathrm{STD}(\mathrm{RAW\_BANKEFFIC}_t):\ \text{Standard deviation of } \mathrm{RAW\_BANKEFFIC}_{f,j,t} \text{ for all banks at } t \end{cases} \tag{5}$$

We also merge the firm-level TFP data provided in East Asian Listed Companies Database (EALC) 2010 compiled by Japan Center for Economic Research (JCER), Center for Economic Institutions (IER, Hitotsubashi University), Center for China and Asian Studies (CCAS, Nihon University), and Center for National Competitiveness (Seoul University). As detailed in Fukao et al. (2011), the TFP level of firm f, industry j in year t, $\mathrm{TFP}_{f,j,t}$ is calculated as follows in the case that the data cover a period from $t = 0$ to T and t_0 $(0 < t < T)$ is the benchmark year. The estimation for each firm's TFP level is implemented as relative to the industry average TFP level. They use the multilateral TFP index method developed by Good et al. (1997).

$$\mathrm{LN}(\mathrm{TFP}_{f,j,t}) = \left\{\mathrm{LN}(\mathrm{Q}_{f,j,t}) - \overline{\mathrm{LN}(\mathrm{Q}_{j,t})}\right\} - \sum_{i=1}^{n}\left(\mathrm{S}_{f,i,j,t} + \overline{\mathrm{S}_{i,j,t}}\right)\left\{\mathrm{LN}(\mathrm{X}_{f,i,j,t}) - \overline{\mathrm{LN}(\mathrm{X}_{i,j,t})}\right\}$$

for $t = t_0$

$$LN(TFP_{f,j,t}) = \left\{LN(Q_{f,j,t}) - \overline{LN(Q_{j,t})}\right\} - \frac{1}{2}\sum_{i=1}^{n}(S_{f,i,j,t} + \overline{S_{i,j,t}})\left\{LN(X_{f,i,j,t}) - \overline{LN(X_{i,j,t})}\right\}$$

$$+ \sum_{s=t_0+1}^{t}\left\{\overline{LN(Q_{j,s})} - \overline{LN(Q_{j,s-1})}\right\} - \sum_{s=t_0+1}^{t}\sum_{i=1}^{n}\frac{1}{2}(\overline{S_{i,j,s}} + \overline{S_{i,j,s-1}})\left\{\overline{LN(X_{i,j,s})} - \overline{LN(X_{i,j,s-1})}\right\}$$

for $t > t_0$

$$LN(TFP_{f,j,t}) = \left\{LN(Q_{f,j,t}) - \overline{LN(Q_{j,t})}\right\} - \frac{1}{2}\sum_{i=1}^{n}(S_{f,i,j,t} + \overline{S_{i,j,t}})\left\{LN(X_{f,i,j,t}) - \overline{LN(X_{i,j,t})}\right\}$$

$$- \sum_{s=t+1}^{t_0}\left\{\overline{LN(Q_{j,s})} - \overline{LN(Q_{j,s-1})}\right\} + \sum_{s=t+1}^{t_0}\sum_{i=1}^{n}\frac{1}{2}(\overline{S_{i,j,s}} + \overline{S_{i,j,s-1}})\left\{\overline{LN(X_{i,j,s})} - \overline{LN(X_{i,j,s-1})}\right\}$$

for $t < t_0$

Here, $Q_{f,j,t}$ stands for the real output (real sales) of firm f in year t, $X_{f,i,j,t}$ represents the real input of production factor i of firm f in year t, and $S_{f,i,j,t}$ is the cost share of production factor i at firm f in year t. $\overline{LN(Q_{j,t})}$ denotes the arithmetic average of the log value of the output, in year t, of all firms in industry j to which firm f belongs, while $\overline{LN(X_{i,j,t})}$ stands for the arithmetic average of the log value of the input of production factor i, in year t, of all firms in industry j to which firm f belongs. Finally, $\overline{S_{i,j,t}}$ is the arithmetic average of the cost share of the input of production factor i, in year t, of all firms in industry j to which firm f belongs.

Since the TFP data is available only up to 2007 fiscal year, the sample periods of our data are reduced to 1997-2007 fiscal year. In order to control for the potential influence of outliers, we excluded observations in the tails for each variable.[14] Table-1 and -2 present a description of the variables used in our empirical analysis. We also exclude the samples

[14] We drop firms for which the absolute levels of each explanatory variable fall over 99th percentile and below 1st percentile.

exhibiting both the TFP and BANKEFFIC take negative numbers to exclude the case where the interaction term between those two items has a positive number although each of them is negative.

4. Model and Estimation Results

As a first step of our empirical analyses, we employ a probit model for firms' dichotomous choice on exports (i.e., extensive margin). Let $\mathrm{EXP\_DUMMY}_{f,j,t}$ denote the dummy variable taking one if the firm in match f in industry j at the period t exports, and zero otherwise. To express the probit model as a latent variable model, suppose there exists an auxiliary random variable Y^* defined as follows.

$$Y^* = \beta_0^P + \beta_1^P \mathrm{TFP}_{f,j,t-1} + \beta_2^P \mathrm{BANKEFFIC}_{f,j,t-1} + \beta_3^P \mathrm{TFP}_{f,j,t-1} \times \mathrm{BANKEFFIC}_{f,j,t-1} + \boldsymbol{\gamma}^P \mathbf{F}_{f,j,t-1} + \delta_1^P \mathrm{INDUSTRY}_j + \delta_2^P \mathrm{LOCATION}_j + \delta_3^P \mathrm{TIME}_t + \epsilon^P \quad (6)$$

where $\epsilon^P \sim N(0,1)$

$\mathrm{TFP}_{f,j,t}$: TFP of Firm in Match-f in Industry-j

$\mathbf{F}_{f,j,t}$: Number of firm employees, leverage, bank dependency, liquidity ratio, etc. (see Table-1)

$\mathrm{INDUSTRY}_j$: Time-invariant dummy variable for industry j

$\mathrm{LOCATION}_f$: Time-invariant dummy variable for the location of the firm in match f

TIME_t: Time dummy for year t

Then, $\mathrm{EXP\_DUMMY}_{f,j,t}$ can be interpreted as an indicator for whether this latent variable is positive or not. The data $\{\mathrm{EXP\_DUMMY}_{f,j,t}, \mathbf{X}_{f,j,t}\}$ where $\mathbf{X}_{f,j,t}$ denotes the right-hand

side explanatory variables in (6) allows us to estimate the model parameters associated with the explanatory variables $\boldsymbol{\beta^P} = \{\beta_0^P, \beta_1^P, \beta_2^P, \beta_3^P, \boldsymbol{\gamma}^P, \delta_1^P, \delta_2^P, \delta_3^P\}$ by maximizing the following log-likelihood function. In order to control the endogeneity of matching between firms and banks, we take lag of all the explanatory variables.[15]

$$\ln L = \sum_{\{f,j,t\}} \left[\text{EXP\_DUMMY}_{f,j,t} \times \ln\Phi\left(\mathbf{X}_{f,j,t-1}\boldsymbol{\beta^P}\right) + \{1 - \text{EXP\_DUMMY}_{f,j,t}\} \times \left\{1 - \ln\Phi\left(\mathbf{X}_{f,j,t-1}\boldsymbol{\beta^P}\right)\right\} \right] \quad (7)$$

As established in many extant literature where firm TFP matters for the dichotomous export decision, we expect the coefficient associated with $\text{TFP}_{f,j,t-1}$ (i.e., $\beta_1^P + \beta_3^P \overline{\text{BANKEFFIC}}$ where $\overline{\text{BANKEFFIC}}$ denotes the average of level of $\text{BANKEFFIC}_{f,j,t-1}$) in (6) takes a positive number. Note that throughout the analysis, we define a match as a pair of a firm and its top lender. In this sense, we limit our attention to the impact of the top lender bank to a firm's export decision.[16] We further hypothesize the marginal effect of $\text{BANKEFFIC}_{f,j,t-1}$ (i.e., β_3^S) in (6) is also positive and the mechanism is more sounding for the firms with low cash-flow. This reflects our conjecture that more efficient banks could mitigate firms' financial friction more effectively and such channel becomes crucial especially for the firms facing tighter cash-flow constraints. To proxy for the constraint, we use firms' ROA computed as the ratio of firms' earnings before interest, tax, and depreciation to firms' total asset. Then, we implement two subsample analysis for the firms

[15] It is another option to control for the match-specific unobservable effect through, for example, the inclusion of a dummy variable. We will also discuss how to control the potential endogeneity associated with the matching mechanism between firms and banks later.

[16] We can immediately come up with other way to set up the match. One important alternative is to define a match as a pair of a firm and its all lender banks. To do so, we need to summarize the productivities of all the lender banks, for example, by weighting each productivity with each loan share.

with their ROA below the median and 25 percentile of whole sample.

Table-3 shows the estimation results based on the probit model.[17] The first column corresponds to the result from all sample estimation. First, the coefficient of $\mathrm{TFP}_{f,j,t-1}$ is negative for the estimation based on the all samples, which is opposite to our prediction ($\beta_1^P + \beta_3^P\overline{\mathrm{BANKEFFIC}} = -0.2835902 + 0.2713803 * 0.3642511 = -0.185$). As one possibility, it could reflect the fact that our data set contains various firm characteristics including wage per worker, which represents firms' productivity. Second, on the other hand, the interaction term in the selection equation $\mathrm{TFP}_{f,j,t-1} \times \mathrm{BANKEFFIC}_{f,j,t-1}$ shows a statistically positive coefficient exactly as we expect. These support our conjecture that a firm's export decision is positively affected by the efficiency of their lender bank. Third, the firm size measured by the natural logarithms of total asset and the wage per worker positively affect the probability of export. All of these have been discussed as the important characteristics determining firms' export choice in the extant papers. Also, the liquidity ratio defined as the ratio of liquidity asset to liability has a positive coefficient. A number of studies surveyed in the previous section use this variable to proxy for the weakness of financial constraint and obtain the similar result. It is important that we find the additional channel coming from the interaction between firm TFP and bank efficiency even when such a variable is properly controlled. Fourth, various measures related to the status of firm's current overseas activities (i.e., overseas cite ratio and investment ratio) contribute to the higher probability of conducting exports.

[17] The number of observations for the Heckman selection model is slightly larger than that for the probit estimation. This is because the samples in some regions always export. In this case, the region dummy variables for those regions could not be used in probit estimation since it completely predicts the dichotomous export decision. In the Heckman selection model, however, those samples could be used if there are some variations in the intensive margins.

The second and third column of Table-3 repeat the same estimation for the samples with low cash-flow (i.e., lower than median and the 25th percentile), which is measured by ROA. The coefficient associated with $\mathrm{TFP}_{f,j,t-1} \times \mathrm{BANKEFFIC}_{f,j,t-1}$ becomes larger and more statistically significant as the cash-flow becomes poorer.[18] It is natural to assume that firms facing lower cash-flow tend to rely more on bank lending, and are affected by the characteristics of the lender banks largely. The result implies more efficient banks could mitigate firm's financial constraints and encourage their client firms' export more effectively when those firms have larger financial needs. Note also that the coefficient associated with TFP is not significantly away from zero for the two subsample analyses. This means that the explanatory power of TFP for the extensive margin of exports is not strong in our sample.

By using the estimated coefficients, we evaluate the economic impacts of BANKEFFIC. Suppose an firm in the third subsample (i.e., ROA<25 percentile) exhibits relatively high TFP (i.e., higher than the sample mean by one standard deviation, i.e., $-0.01 + 0.09 = 0.08$), and switches its top lender from the average banks (i.e., $\mathrm{BANKEFFIC} = 0.36$) to the banks with higher BANKEFFIC than the average by one standard deviation (i.e., 0.87). Considering that $\beta_3^P = 1.063104$ in this case, the probability of the firm to export increases by 10.5% $(= \{1.063104 * (0.36 + 0.87)\} * 0.08)$. This is not economically negligible impact.

Next, we study the impacts of the covariates used in (6) onto the ratio of export

[18] Note that the means and the standard deviations of $\mathrm{TFP}_{f,j,t-1} \times \mathrm{BANKEFFIC}_{f,j,t-1}$ for those three samples (i.e., all samples, lower than median or 25th percentile of cash-flow) are comparable (i.e., .{ -0.0355587, 0.0759481 }, { -0.0432631, 0.0655266}, and {-0.0578274, 0.0728884}).

to the total sales denoted by $\mathrm{OVERSEAS\_SALES\_RATIO}_{f,j,t-1}$ through a simple OLS estimation as in (8). This estimation also aims at pining down the covariates not affecting the intensive margin. We consider the results to choose the variables for the Heckman selection model estimated later.

$$\begin{cases} \mathrm{OVERSEAS\_SALES\_RATIO}_{f,j,t-1} = \mathbf{X}_{f,j,t-1}\boldsymbol{\beta}^{\mathbf{O}} + \epsilon^{O} \quad (8) \\ \text{where} \\ \epsilon^{P} \sim N(0,1) \end{cases}$$

Table-4 shows the results based on the OLS estimation. While the similar patters to the probit estimation could be partly found, the coefficients of the terms related to bank efficiency are mostly muted. This implies that the contribution of lender banks is mainly found in the choice of extensive but not intensive margin. Some of the covariates including F_STL, WAGE_PER_WORKER, and OVERSEAS_EMP_RATIO are also not significant in most cases. This is to some extent consistent with the mixed findings in the extant studies about the impact of firms' domestic characteristics onto their overseas sales.

Based on the separated analyses for the extensive and intensive margins, Table-5 employs the Heckman's selection model (Gronau 1974; Lewis 1974; Heckman 1976), which is also used in the extant literature in this topic (e.g., Amiti and Weinstein 2011; Belone 2010; Minetti 2011). We use this model due to the censoring problem associated with firms' export data. Considering the fact that only a part of companies are exporting, the standard OLS technique might not be applicable to the actually observed export data due to the

selection bias. The Heckman selection model is appropriate for taking into account the dichotomous choice on export (i.e., export or not). The underlying regression relationship on the determination of export intensity, which is measured as the overseas sales ratio of sample firms is as in (9).

$$
\begin{cases}
\text{OVERSEAS\_SALES\_RATIO}_{f,j,t-1} = \mathbf{X}_{f,j,t-1}\boldsymbol{\beta}^{\mathbf{O}} + \epsilon^{O} & (9a) \\
\text{if} \quad Y^{*} = \beta_0^{H} + \beta_1^{H}\text{TFP}_{f,j,t-1} + \beta_2^{H}\text{BANKEFFIC}_{f,j,t-1} + \beta_3^{H}\text{TFP}_{f,j,t-1} \times \text{BANKEFFIC}_{f,j,t-1} + \boldsymbol{\gamma}^{H}\mathbf{F}_{f,j,t-1} & \\
\qquad + \delta_1^{H}\text{INDUSTRY}_{j} + \delta_2^{H}\text{LOCATION}_{j} + \delta_3^{H}\text{TIME}_{t} + \epsilon^{H} > 0 & (9b) \\
\text{where} \quad \epsilon^{P} \sim N(0,1),\ \epsilon^{O} \sim N(0,1) & \\
\mathbf{X}_{f,j,t-1}\text{: The covariates other than F\_STL, WAGE\_PER\_WORKER, OVERSEAS\_EMP\_RATIO} & \\
\text{corr}(\epsilon_1, \epsilon_2) = \rho \neq 0 &
\end{cases}
$$

As pointed out above, the dependent variable in the regression equation (9a) is observed only when the second selection equation (9b) takes a positive number. In other words, the export intensity is censored if the firms are not deciding to sell abroad. The selection model is required when ρ is apart from zero, which means the existence of the connection between the regression equation and selection equation. We estimate the model consisting of (9a) and (9b) to see how the impact of $\text{TFP}_{f,j,t-1}$ onto firm's export behavior (i.e., dichotomous choice on export and the choice of export intensity) is interacted with the level of $\text{BANKEFFIC}_{f,j,t-1}$. Since we do not have a robust presumption about the variables used only for the first-stage selection equation, we consider the results in Table-4 and, exclude F_STL, WAGE_PER_WORKER, and OVERSEAS_EMP_RATIO from the

selection equation. The results are summarized in Table-5. We could immediately observe the similarity of the results to that in Table-3.

In order to check the robustness of our results, we consider the argument in Todo (2011) that firms' export choice is largely explained by firms' own experience of exports. Table-6 (1) adds the one-period lagged dummy variable, which takes one if the firm is conducting export at $t-1$, to the probit estimation. We presume that the lagged export dummy could substitute the TFP since the firms with higher TFP are more likely to already conduct exports. The coefficient of the lagged export dummy is positive as in Todo (2009). At the same tile, the estimated coefficients associated with the interaction term for the cases of all samples and the sample with ROA lower than the median become not significantly away from zero. This implies that a part of the results in Table-3 is generated by firms' own experience of exports. Nonetheless, the interaction term between firm's and bank's productivities is still significantly positive for the samples with very low cash-flow. Thus, those who face severe cash-flow constraints decides their export choices based not only on their own experiences but on the characteristics of the related parties.

We would further ask how the efficiency of lender banks contribute to the export decision. Presumably, it could encourage the initiation of the exports as well as help the firms already exporting to keep in the status. To explicitly study this issue, Table-6 (2) and (3) split the sample into two groups. First, we redefine $\mathrm{EXP\_DUMMY}_{f,j,t}$ as the "fresh export" dummy variable taking one if the firm has not exported to a region in our sample until the period t-1 and start at t to the region.[19] Such firms showing $\mathrm{EXP\_DUMMY}_{f,j,t} = 1$

[19] The regions include Asia, Northern America, Central and South America, Oceania, and Africa. The sample

is pooled with the firms never export. This exercise allows us whether $\mathrm{BANKEFFIC}_{f,j,t-1}$ helps firms without experience to initiate exports.[20] Second, we redefine $\mathrm{EXP\_DUMMY}_{f,j,t}$ as the "lose export" dummy variable taking one if the firm has exported to a region in our sample until the period t-1 and stop exporting at t to the region.[21] Such firms showing $\mathrm{EXP\_DUMMY}_{f,j,t} = 1$ is pooled with the firms always export. This exercise allows us whether $\mathrm{BANKEFFIC}_{f,j,t-1}$ helps exporter firms to sustain the exporter status. The results in Table-6 (2) imply that highly efficient banks could be helpful for the firms with severe cash-flow constraint to initiate exports. On the other hand, Table-6 (3) shows that lender banks are more or less unrelated to firms' decision to terminate their exports.

One technical issue we should note is the potential endogeneity problem associated with the matching between the bank and firm in the match. The approach of this paper is to argue that the relations between sample firms and banks are kept for long periods, which alleviates the endogeneity problem. If the relation itself is predetermined, the simultaneous equation bias discussed below does not emerge. Nonetheless, we could still have a good reason to be worried about the endogeneity problem. Suppose a firm planning to export in period t is seeking a potential financier at period t-1. If this firm systematically match with the firms with higher $\mathrm{BANKEFFIC}_{f,j,t-1}$, the efficiency of bank in math f in period t-1 is affected by the firm's export decision at period t as well as other determinants of $\mathrm{BANKEFFIC}_{f,j,t-1}$ (e.g., $\mathrm{BANKEFFIC}_{f,j,t-2}$ and other bank characteristics

---

contains the information about Western Europe, Russia, and Eastern Europe, which we ignore due to the limited number of samples.

[20] Alternatively, we could redefine the dummy variable as it takes one if the firm has never exported in our sample and start to export at t.

[21] The regions include Asia, Northern America, Central and South America, Oceania, and Africa. The sample contains the information about Western Europe, Russia, and Eastern Europe, which we ignore due to the limited number of samples.

at period t-1 $\mathrm{BANK}_{f,j,t-2}$) as in (10). To avoid the bias emerged from the simultaneous equation system of (6) and (10), for example, we need to employ proper instrument variables such as $\mathrm{BANKEFFIC}_{f,j,t-2}$ and/or $\mathrm{BANK}_{f,j,t-2}$. We leave this to our future task.

$$\mathrm{BANKEFFIC}_{f,j,t-1} = \alpha_0^S + \alpha_1^S \mathrm{EXP\_DUMMY}_{f,j,t} + \alpha_2^S \mathrm{BANKEFFIC}_{f,j,t-2} + \gamma^S \mathrm{BANK}_{f,j,t-2} + \varepsilon \qquad (10)$$

To summarize, we have confirmed the positive impact of bank's efficiency to the client firm's export decision. Among the extant studies, Amiti and Weinstein (2011) finds the similar mechanism by using the Japanese firm-bank match data in 1990s. The distinctive feature of our study is in the finding that the channel becomes more sounding when the firms are facing larger cash-flow constraints. It is also kept to be significant even if we control firms' past experiences of exports as in Todo (2011). In addition to this new dimension, we find that the role of efficient banks is mainly for supporting the firms to start export, which is not taken into account in Amiti and Weinstein (2011).

The results obtained in this paper provide several policy implications. First, the supervising for banking industry is confirmed to be very important since it crucially affect firm's real activity. In the past studies, the impact of malfunctioning banks onto their client firms' capital investment, R&D investment, and growth have been discussed (e.g., Hennessy et al. 2007; Miyakawa et al. 2011). Such a caution is applicable to the context of exports. Considering the fact that Japanese economy heavily relies on the success of selected manufacturing firms committing active exports, it is highly recommendable for financial authority to supervise banks so as to improve the quality of banking activities,

which promotes the Japanese firms' exports. Second, the governmental provision of financial services could be justified when most of financial institutions are in very bad shapes. As in the same spirit of the many extant literature surveyed in the previous section, for example, the rescued financial provision during financial crisis could be largely justified from the results obtained in this paper.

5. Conclusion

This paper empirically studies the impact of banks' efficiency on their client firms' export behavior, former of which is measured by the modified FISIM and banks' cost information. Many empirical studies inspired by Melitz (2003) have been establishing the impact of firm's TFP on their export behavior. Following this strand of literature, we test whether firms' export activities are affected by their lender banks' efficiency as well as the firms' own characteristics including TFP. The estimation results show that firms' dichotomous choice on export is positively affected by the interaction term between firms' TFP and the top lender bank's efficiency. Moreover, we find this channel becomes more sounding for the firms facing larger cash-flow constraint. This implies that more efficient banks mitigate firm's financial constraints and encourage their client firms' export more effectively when those firms have larger financial needs. It also implies the necessity of extending the discussion about the determinants of firms' overseas activities to characteristics of related parties.

To conclude, we list several future research questions. First, it is our another interest how match-specific characteristics, for example the share of loan, the duration of

loan relations, and/or the dynamics of relations, have interactions with the bank efficiency for the determination of client firm's overseas activities. Second, the explicit studies on the matching mechanism between firms and banks is our another interest. The joint study of the matching mechanism and the ex-post performance of the match (e.g., successfulness of the overseas activities) could provide the further policy implication about how the governmental sector intervenes the banking markets. We believe all of these extensions provide further guides for better understanding of the firm's overseas activities and the role of banks.

<Table and Figure>

Table-1: Summary Statistics

Variable	Definition	Obs	Mean	Std.Dev.	Min	Max
OVERSEAS_SALES_RATIO	Oveaseas sales total / Total sales	2287	0.30	0.35	0.00	1.22
EXP_DUMMY	Dummy variable taking one if export	2828	0.81	0.39	0.00	1.00
F_WORKER	Log of #(Firm's Total Worker)	2828	7.19	1.18	3.99	10.60
F_LEV	Firm's Liability / Total Asset	2828	0.55	0.17	0.09	0.96
F_BDEP	Firm's Bank Loan / Total Liability	2828	0.32	0.20	0.00	0.88
F_LIQ	Firm's Liquidity Asset / Liquility	2828	1.57	0.80	0.37	7.66
F_STL	Firm's Short-Term Borrowing / Total Borrowing	2828	0.55	0.32	0.00	1.00
WAGE_PER_WORKER	Total Wage / #(Total Workers)	2828	6.75	1.74	0.69	12.68
OVERSEAS_CITE_RATIO	#(Overseas Cite) / #(Total Cite)	2828	0.06	0.12	0.00	0.71
OVERSEAS_EMP_RATIO	#(Overseas Employees) / #(Total Employees)	2828	0.00	0.01	0.00	0.08
OVERSEAS_INV_RATIO	Overseas Investment / Tangible Asset	2828	0.29	0.44	0.00	3.34
OVERSEAS_LLOAN_RATIO	Overseas Long-term Loan / Long-term Loan	2828	0.11	0.26	0.00	1.00
F_TFP	Firm's Total Factor Productivity	2828	-0.01	0.09	-0.54	0.35
F_TFP × B_EFFIC	Interaction term	2828	-0.04	0.08	-0.60	0.36
B_EFFIC	Bank's Modified FISIM Output / Operational Cost	2828	0.36	0.87	-2.34	1.81

Note: These numbers are computed for the samples containing some data for all the variables other than OVERSEAS_SALES_RATIO. The number of observation is slightly larger than that used for our estimation due to the fact that some region dummy variables completely predict the dichotomous export choice.

Table

Obs = 2287

Variable	OVERSEAS_SALES_RATIO	F_WORKER	F_LEV	F_BDEP	F_LIQ	F_STL	WAGE_PER_WORKER	OVERSEAS_CITE_RATIO	OVERSEAS_EMP_RATIO	OVERSEAS_INV_RATIO	OVERSEAS_LLOAN_RATIO	F_TFP	F_TFP×B_EFFIC	B_EFFIC
OVERSEAS_SALES_RATIO	1.00													
F_WORKER	0.17	1.00												
F_LEV	−0.01	0.04	1.00											
F_BDEP	−0.06	−0.35	0.46	1.00										
F_LIQ	0.04	−0.05	−0.68	−0.42	1.00									
F_STL	0.03	−0.07	0.02	−0.01	−0.08	1.00								
WAGE_PER_WORKER	−0.01	0.21	0.01	−0.17	−0.03	−0.03	1.00							
OVERSEAS_CITE_RATIO	0.08	0.16	−0.03	−0.11	0.02	−0.02	0.08	1.00						
OVERSEAS_EMP_RATIO	0.07	−0.03	−0.08	−0.09	0.06	0.02	0.05	0.65	1.00					
OVERSEAS_INV_RATIO	0.06	0.17	−0.14	−0.13	0.06	−0.08	0.13	0.18	0.20	1.00				
OVERSEAS_LLOAN_RATIO	−0.16	0.03	−0.12	−0.05	0.08	−0.05	0.04	0.03	0.05	0.14	1.00			
F_TFP	−0.19	0.03	−0.19	−0.19	0.10	−0.10	0.20	0.03	0.01	0.16	0.12	1.00		
F_TFP×B_EFFIC	−0.19	−0.06	−0.08	−0.07	−0.03	0.00	0.05	0.00	0.00	0.04	0.06	0.38	1.00	
B_EFFIC	0.28	−0.10	0.09	0.07	−0.04	0.17	−0.14	−0.03	−0.02	−0.14	−0.12	−0.42	0.15	1

-2: Correlation Coefficient

	(1A) All Samples		(1B) F_ROA<Median		(1C) F_ROA<25th Percentile	
Probit: EXP_DUMMY (t)	dF/dX	Robust Std.	dF/dX	Robust Std.	dF/dX	Robust Std.
F_WORKER (t-1)	0.068158	0.009096 ***	0.067045	0.014978 ***	0.081375	0.025466 ***
F_LEV (t-1)	0.071934	0.075958	0.102428	0.123167	0.284004	0.197366
F_BDEP (t-1)	0.159550	0.050766 ***	0.149827	0.086899 *	0.456998	0.135004 ***
F_LIQ (t-1)	0.040843	0.015663 ***	0.066395	0.030247 **	0.115634	0.053363 **
F_STL (t-1)	0.039577	0.026322	0.095376	0.048347 **	-0.025650	0.078225
WAGE_PER_WORKER (t-1)	0.016087	0.005224 ***	0.019453	0.008583 **	0.018651	0.014341
OVERSEAS_CITE_RATIO (t-1)	0.245111	0.110886 **	-0.031707	0.204057	-0.631507	0.319782 **
OVERSEAS_EMP_RATIO (t-1)	0.794706	1.777378	2.013158	3.347868	6.714929	5.184311
OVERSEAS_INV_RATIO (t-1)	0.157035	0.041101 ***	0.147387	0.064849 **	0.175852	0.121292
OVERSEAS_LLOAN_RATIO (t-1)	0.009418	0.033431	0.023118	0.058878	-0.028451	0.094115
F_TFP (t-1)	-0.283590	0.125632 **	-0.057635	0.214900	0.059612	0.272187
F_TFP×B_EFFIC (t-1)	0.271380	0.118670 **	0.612078	0.202375 ***	1.063104	0.273317 ***
B_EFFIC (t-1)	0.008556	0.008852	0.015083	0.015582	0.048316	0.027544 *
Log pseudo likelihood	-1206.5356		-507.6063		-223.2635	
# Obs	2815		1132		500	
Wald chi2	530.40		243.23		131.81	
Prob > chi2	0.0000		0.0000		0.0000	
Pseudo R2	0.2421		0.2350		0.2628	
Industry-Dummy	yes		yes		yes	
Location-Dummy	yes		yes		yes	
Time-Dummy	yes		yes		yes	

Note: ***:1%,**:5%, *:10%. F_ROA stands for the EBITDA / TOTAL Asset which proxies for the cash-flow ratio. F_WORKER denotes the log of the number of firm's total worker, F_LEV is the ratio of firm's total liability to total Asset, F_BDEP is the ratio of firm's bank Loan to total liability, F_LIQ is the ratio of firm's liquidity Asset to liquility, F_STL is the ratio of firm's short-term borrowing to total borrowing, WAGE_PER_WORKER is the ratio of total wage to the number of total workers, OVERSEAS_CITE_RATIO is the ratio of the number of overseas cite to the number of total cite, OVERSEAS_EMP_RATIO is the ratio of overseas employees to the number of total employeesm, OVERSEAS_INV_RATIO is the ratio of overseas investment to tangible asset, OVERSEAS_LLOAN_RATIO is the ratio of overseas long-term loan to long-term loan, F_TFP is firm's total factor productivity, and B_EFFIC is the ratio of bank's modified FISIM output to operational cost. dF/dx denotes the estimated marginal effect.

Table-3: Probit Estimation for Extensive Margin

Table-4: OLS Estimation for Intensive Margin

	(2A) All Samples		(2B) F_ROA<Median		(2C) F_ROA<25th Percentile	
OLS: OVERSEAS_SALES_RATIO (t)	Coef.	Robust Std.	Coef.	Robust Std.	Coef.	Robust Std.
F_WORKER (t-1)	0.039753	0.004033 ***	0.025910	0.006354 ***	0.035100	0.010010 ***
F_LEV (t-1)	-0.090363	0.035183 ***	-0.047130	0.049754	-0.029372	0.078733
F_BDEP (t-1)	0.088482	0.024341 ***	0.085863	0.033737 **	0.083194	0.050184 *
F_LIQ (t-1)	0.013265	0.008660	0.024280	0.013741 *	0.026645	0.022959
F_STL (t-1)	0.000644	0.011609	-0.016697	0.018572	0.005561	0.032958
WAGE_PER_WORKER (t-1)	0.001095	0.002112	-0.000117	0.003273	0.009316	0.004910 *
OVERSEAS_CITE_RATIO (t-1)	0.172991	0.042947 ***	0.132304	0.079590 *	-0.147656	0.114475
OVERSEAS_EMP_RATIO (t-1)	-0.328568	0.672098	0.809959	1.212541	3.130407	1.702707 *
OVERSEAS_INV_RATIO (t-1)	0.083780	0.010011 ***	0.091717	0.016209 ***	0.081811	0.023134 ***
OVERSEAS_LLOAN_RATIO (t-1)	-0.034963	0.012355 ***	-0.018963	0.020424	0.004738	0.037912
F_TFP (t-1)	0.072439	0.057483	0.078980	0.102051	-0.116125	0.153511
F_TFP×B_EFFIC (t-1)	-0.049970	0.045966	-0.035899	0.086698	-0.317400	0.118843 ***
B_EFFIC (t-1)	0.003806	0.003743	0.000055	0.006676	-0.015498	0.011070
cons	-0.220171	0.052408 ***	-0.195166	0.078259 **	-0.195808	0.107423 *
# Obs	2136		902		398	
F	41.96		22.19		.	
Prob > F	0.0000		0.0000		.	
R-squared	0.3350		0.3351		0.3789	
Root MSE	0.1540		0.1491		0.1478	
Industry-Dummy	yes		yes		yes	
Location-Dummy	no		no		no	
Time-Dummy	yes		yes		yes	

Note: ***:1%,**:5%, *:10%. F_ROA stands for the EBITDA / TOTAL Asset which proxies for the cash-flow ratio. F_WORKER denotes the log of the number of firm's total worker, F_LEV is the ratio of firm's total liability to total Asset, F_BDEP is the ratio of firm's bank Loan to total liability, F_LIQ is the ratio of firm's liquidity Asset to liquility, F_STL is the ratio of firm's short-term borrowing to total borrowing, WAGE_PER_WORKER is the ratio of total wage to the number of total workers, OVERSEAS_CITE_RATIO is the ratio of the number of overseas cite to the number of total cite, OVERSEAS_EMP_RATIO is the ratio of overseas employees to the number of total employeesm, OVERSEAS_INV_RATIO is the ratio of overseas investment to tangible asset, OVERSEAS_LLOAN_RATIO is the ratio of overseas long-term loan to long-term loan, F_TFP is firm's total factor productivity, and B_EFFIC is the ratio of bank's modified FISIM output to operational cost. dF/dx denotes the estimated marginal effect.

Table-5: Heckman Selection Model

	(3A) All Samples		(3B) F_ROA<Median		(3C) F_ROA<25th Percentile	
Intensity: OVERSEAS_SALES_RATIO (t)	Coef.	Std.	Coef.	Std.	Coef.	Std.
F_WORKER (t-1)	0.049284	0.004878 ***	0.020822	0.006301 ***	0.015029	0.009960
F_LEV (t-1)	-0.053033	0.032188 *	-0.030179	0.046114	-0.061966	0.074014
F_BDEP (t-1)	0.109040	0.024073 ***	0.076985	0.032610 **	0.027907	0.060711
F_LIQ (t-1)	0.015096	0.006559 **	0.020998	0.010229 **	0.002533	0.017621
OVERSEAS_CITE_RATIO (t-1)	0.182911	0.029224 ***	0.150557	0.040403 ***	0.049403	0.067464
OVERSEAS_INV_RATIO (t-1)	0.100693	0.009608 ***	0.098364	0.013534 ***	0.084475	0.022587 ***
OVERSEAS_LLOAN_RATIO (t-1)	-0.025281	0.013303 *	-0.023918	0.019208	0.007729	0.030393
F_TFP (t-1)	0.040415	0.053634	0.030613	0.085842	-0.136429	0.130671
F_TFP×B_EFFIC (t-1)	-0.018940	0.047071	-0.041065	0.078503	-0.398727	0.124072 ***
B_EFFIC (t-1)	0.006285	0.003999	0.002078	0.005840	-0.010900	0.010108
_cons	-0.382985	0.110520 ***	-0.227701	0.131418 *	-0.039627	0.206689
Selection: EXP_DUMMY (t)	Coef.	Std.	Coef.	Std.	Coef.	Std.
F_WORKER (t-1)	0.252692	0.030245 ***	0.229906	0.048150 ***	0.268574	0.077008 ***
F_LEV (t-1)	0.266682	0.280405	0.351246	0.434705	0.937360	0.691166
F_BDEP (t-1)	0.591523	0.197240 ***	0.513797	0.318882	1.508314	0.496635 ***
F_LIQ (t-1)	0.151421	0.059997 **	0.227674	0.111126 **	0.381640	0.181421 **
F_STL (t-1)	0.146736	0.099543	0.327075	0.169227 *	-0.084658	0.273189
WAGE_PER_WORKER (t-1)	0.059643	0.018417 ***	0.066712	0.027652 **	0.061556	0.043866
OVERSEAS_CITE_RATIO (t-1)	0.908691	0.402222 **	-0.108707	0.648074	-2.084245	1.097687 *
OVERSEAS_EMP_RATIO (t-1)	2.946644	5.954783	6.903130	10.582030	22.162760	17.621220
OVERSEAS_INV_RATIO (t-1)	0.582174	0.096448 ***	0.505393	0.134706 ***	0.580391	0.220700 ***
OVERSEAS_LLOAN_RATIO (t-1)	0.034930	0.122432	0.079287	0.200078	-0.093886	0.315798
F_TFP (t-1)	-1.051358	0.451501 **	-0.197507	0.741886	0.196783	1.019748
F_TFP×B_EFFIC (t-1)	1.006094	0.418537 **	2.098783	0.743745 ***	3.508706	1.150971 ***
B_EFFIC (t-1)	0.031721	0.034919	0.051719	0.057395	0.159465	0.100241
_cons	2.123236	444.6666	1.810089	724.4123	0.860060	894.9339
Mills lambda	0.126081	0.034519 ***	-0.002828	0.045811	-0.125387	0.068663 *
rho	0.781780		-0.020580		-0.867750	
# Obs	2859		1214		547	
# Censored Obs	723		312		149	
# Uncensored Obs	2136		902		398	
Wald chi2	785.12		450.69		293.48	
Prob > chi2	0.00		0.00		0.00	
Industry-Dummy	yes		yes		yes	
Location-Dummy	yes		yes		yes	
Time-Dummy	yes		yes		yes	

Note: ***:1%,**:5%, *:10%. F_ROA stands for the EBITDA / TOTAL Asset which proxies for the cash-flow ratio. F_WORKER denotes the log of the number of firm's total worker, F_LEV is the ratio of firm's total liability to total Asset, F_BDEP is the ratio of firm's bank Loan to total liability, F_LIQ is the ratio of firm's liquidity Asset to liquility, F_STL is the ratio of firm's short-term borrowing to total borrowing, WAGE_PER_WORKER is the ratio of total wage to the number of total workers, OVERSEAS_CITE_RATIO is the ratio of the number of overseas cite to the number of total cite, OVERSEAS_EMP_RATIO is the ratio of overseas employees to the number of total employeesm, OVERSEAS_INV_RATIO is the ratio of overseas investment to tangible asset, OVERSEAS_LLOAN_RATIO is the ratio of overseas long-term loan to long-term loan, F_TFP is firm's total factor productivity, and B_EFFIC is the ratio of bank's modified FISIM output to operational cost. dF/dx denotes the estimated marginal effect.

Table-6 (1): Probit with Lagged Export Dummy

	(4-1A) All Samples		(4-1B) F_ROA<Median		(4-1C) F_ROA<25th Percentile	
Probit: EXP_DUMMY (t)	dF/dX	Robust Std.	dF/dX	Robust Std.	dF/dX	Robust Std.
EXP_DUMMY (t-1)	0.789137	0.019850 ***	0.823089	0.025209 ***	0.898727	0.026147 ***
F_WORKER (t-1)	0.045179	0.009890 ***	0.032287	0.016653 *	0.063023	0.032842 **
F_LEV (t-1)	-0.021104	0.089159	0.027890	0.149330	0.028616	0.262148
F_BDEP (t-1)	0.095652	0.060530	0.034361	0.101011	0.384454	0.161324 **
F_LIQ (t-1)	0.013660	0.017410	0.005331	0.032855	0.082894	0.073262
F_STL (t-1)	0.004814	0.031118	0.068745	0.056545	0.093645	0.098683
WAGE_PER_WORKER (t-1)	0.004167	0.006456	0.015078	0.010341	0.012904	0.019440
OVERSEAS_CITE_RATIO (t-1)	0.115993	0.116729	-0.073575	0.197128	-0.861790	0.324038 ***
OVERSEAS_EMP_RATIO (t-1)	-1.285391	1.591350	-3.103525	2.860558	3.605735	4.803944
OVERSEAS_INV_RATIO (t-1)	0.067213	0.033022 **	0.075107	0.053507	0.097199	0.097522
OVERSEAS_LLOAN_RATIO (t-1)	-0.019087	0.036815	0.003367	0.065609	-0.140007	0.127618
F_TFP (t-1)	-0.441208	0.142578 ***	-0.478373	0.255517 *	-0.338919	0.395845
F_TFP×B_EFFIC (t-1)	0.180775	0.137409	0.203255	0.309555	0.635712	0.328026 *
B_EFFIC (t-1)	0.001739	0.010507	-0.002643	0.021415	-0.000006	0.037674
Log pseudo likelihood	-738.9650		-261.4997		-100.7700	
# Obs	2815		1132		500	
Wald chi2	1066.40		628.08		429.31	
Prob > chi2	0.0000		0.0000		0.0000	
Pseudo R2	0.5358		0.6059		0.6673	
Industry-Dummy	yes		yes		yes	
Location-Dummy	yes		yes		yes	
Time-Dummy	yes		yes		yes	

Note: ***:1%,**:5%, *:10%. F_ROA stands for the EBITDA / TOTAL Asset which proxies for the cash-flow ratio. F_WORKER denotes the log of the number of firm's total worker, F_LEV is the ratio of firm's total liability to total Asset, F_BDEP is the ratio of firm's bank Loan to total liability, F_LIQ is the ratio of firm's liquidity Asset to liquility, F_STL is the ratio of firm's short-term borrowing to total borrowing, WAGE_PER_WORKER is the ratio of total wage to the number of total workers, OVERSEAS_CITE_RATIO is the ratio of the number of overseas cite to the number of total cite, OVERSEAS_EMP_RATIO is the ratio of overseas employees to the number of total employeesm, OVERSEAS_INV_RATIO is the ratio of overseas investment to tangible asset, OVERSEAS_LLOAN_RATIO is the ratio of overseas long-term loan to long-term loan, F_TFP is firm's total factor productivity, and B_EFFIC is the ratio of bank's modified FISIM output to operational cost. dF/dx denotes the estimated marginal effect.

Table-6 (2): Probit for Fresh Export Dummy

	(4-2A) All Samples		(4-2B) F_ROA<Median		(4-2C) F_ROA<25th Percentile	
Probit: FRESH_EXP_DUMMY (t)	dF/dX	Robust Std.	dF/dX	Robust Std.	dF/dX	Robust Std.
F_WORKER (t-1)	0.041599	0.009662 ***	0.054865	0.015830 ***	0.053956	0.028034 *
F_LEV (t-1)	0.143589	0.089223	0.056086	0.146773	0.354675	0.244901
F_BDEP (t-1)	-0.043498	0.063406	0.087306	0.101172	0.118187	0.154033
F_LIQ (t-1)	-0.003542	0.016968	0.009256	0.030456	0.064247	0.056905
F_STL (t-1)	0.037932	0.031678	0.013489	0.055018	-0.097588	0.092060
WAGE_PER_WORKER (t-1)	0.005304	0.006140	0.013420	0.009542	0.004158	0.015685
OVERSEAS_CITE_RATIO (t-1)	0.087262	0.109371	-0.264814	0.190892	-0.465168	0.310516
OVERSEAS_EMP_RATIO (t-1)	0.266089	1.533455	3.572528	2.944670	5.922002	4.401387
OVERSEAS_INV_RATIO (t-1)	0.048607	0.023851 **	0.043520	0.037292	0.119947	0.084361
OVERSEAS_LLOAN_RATIO (t-1)	0.026949	0.035491	-0.032073	0.059102	-0.050563	0.099636
F_TFP (t-1)	-0.208155	0.137688	-0.015428	0.227064	-0.074184	0.299719
F_TFP×B_EFFIC (t-1)	0.187790	0.129644	0.319044	0.248752	0.910088	0.364603 **
B_EFFIC (t-1)	-0.007749	0.011085	-0.005312	0.018706	0.026397	0.034924
Log pseudo likelihood	-1085.5097		-438.4275		-174.8160	
# Obs	2301		972		425	
Wald chi2	439.66		252.94		150.81	
Prob > chi2	0.0000		0.0000		0.0000	
Pseudo R2	0.1868		0.2416		0.3341	
Industry-Dummy	yes		yes		yes	
Location-Dummy	yes		yes		yes	
Time-Dummy	yes		yes		yes	

Note: ***:1%,**:5%, *:10%. The dependent variable is a dummy variable taking one if the sample firm starts to export to some regions conditional on that it has not exported to the region so far. F_ROA stands for the EBITDA / TOTAL Asset which proxies for the cash-flow ratio. F_WORKER denotes the log of the number of firm's total worker, F_LEV is the ratio of firm's total liability to total Asset, F_BDEP is the ratio of firm's bank Loan to total liability, F_LIQ is the ratio of firm's liquidity Asset to liquility, F_STL is the ratio of firm's short-term borrowing to total borrowing, WAGE_PER_WORKER is the ratio of total wage to the number of total workers, OVERSEAS_CITE_RATIO is the ratio of the number of overseas cite to the number of total cite, OVERSEAS_EMP_RATIO is the ratio of overseas employees to the number of total employeesm, OVERSEAS_INV_RATIO is the ratio of overseas investment to tangible asset, OVERSEAS_LLOAN_RATIO is the ratio of overseas long-term loan to long-term loan, F_TFP is firm's total factor productivity, and B_EFFIC is the ratio of bank's modified FISIM output to operational cost. dF/dx denotes the estimated marginal effect.

Table-6 (3): Probit for Lose Export Dummy

	(4-3A) All Samples		(4-3B) F_ROA<Median		(4-3C) F_ROA<25th Percentile	
Probit: LOSE_EXP_DUMMY (t)	dF/dX	Robust Std.	dF/dX	Robust Std.	dF/dX	Robust Std.
F_WORKER (t-1)	-0.053246	0.011498 ***	-0.070764	0.018545 ***	-0.067345	0.029966 **
F_LEV (t-1)	0.009195	0.097054	0.004125	0.157505	0.022209	0.249170
F_BDEP (t-1)	-0.061323	0.070219	0.132895	0.111198	0.210516	0.170222
F_LIQ (t-1)	-0.009056	0.019061	0.031125	0.033785	0.059364	0.057998
F_STL (t-1)	0.025366	0.034049	0.025342	0.058343	0.100528	0.098268
WAGE_PER_WORKER (t-1)	-0.007705	0.006890	-0.018517	0.010779 *	-0.027907	0.018819
OVERSEAS_CITE_RATIO (t-1)	0.057991	0.107644	0.180371	0.182310	0.462141	0.317989
OVERSEAS_EMP_RATIO (t-1)	-1.202207	1.616218	-1.202776	3.074542	-1.061976	4.900135
OVERSEAS_INV_RATIO (t-1)	-0.007594	0.025396	-0.046009	0.042297	-0.078812	0.072960
OVERSEAS_LLOAN_RATIO (t-1)	-0.011665	0.040449	0.001805	0.065135	0.107652	0.107937
F_TFP (t-1)	0.365800	0.161361 **	0.732935	0.289101 **	0.770473	0.434719 *
F_TFP×B_EFFIC (t-1)	-0.094588	0.141282	-0.139055	0.259370	-0.394324	0.348109
B_EFFIC (t-1)	-0.008339	0.012018	-0.027124	0.020454	-0.035163	0.034068
Log pseudo likelihood	-1199.1057		-452.6719		-181.6165	
# Obs	2284		911		396	
Wald chi2	404.86		201.08		119.37	
Prob > chi2	0.0000		0.0000		0.0000	
Pseudo R2	0.1515		0.1911		0.2622	
Industry-Dummy	yes		yes		yes	
Location-Dummy	yes		yes		yes	
Time-Dummy	yes		yes		yes	

Note: ***:1%,**:5%, *:10%. The dependent variable is a dummy variable taking one if the sample firm stops to export to some regions conditional on that it has exported to the region so far. F_ROA stands for the EBITDA / TOTAL Asset which proxies for the cash-flow ratio. F_WORKER denotes the log of the number of firm's total worker, F_LEV is the ratio of firm's total liability to total Asset, F_BDEP is the ratio of firm's bank Loan to total liability, F_LIQ is the ratio of firm's liquidity Asset to liquility, F_STL is the ratio of firm's short-term borrowing to total borrowing, WAGE_PER_WORKER is the ratio of total wage to the number of total workers, OVERSEAS_CITE_RATIO is the ratio of the number of overseas cite to the number of total cite, OVERSEAS_EMP_RATIO is the ratio of overseas employees to the number of total employeesm, OVERSEAS_INV_RATIO is the ratio of overseas investment to tangible asset, OVERSEAS_LLOAN_RATIO is the ratio of overseas long-term loan to long-term loan, F_TFP is firm's total factor productivity, and B_EFFIC is the ratio of bank's modified FISIM output to operational cost. dF/dx denotes the estimated marginal effect.

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